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THE ART AND SCIENCE OF NUTRITION

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A Textbook on the Theory and Application of Nutrition

BY

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AND

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(Retired)

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To the
memory of
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PREFACE TO THIRD EDITION

This book is designed to cover briefly the fundamentals of nutrition. It, therefore, includes several chapters which perhaps are not regularly included in books on dietetics but which must be included under the broader term nutrition. Such chapters include digestion, the blood, the endocrines, and some appendix material. For those whose time or interest is limited, they may be omitted. For those who have more time or added interest, they are again included in the third edition. It is difficult to adapt data to all time factors and scholastic levels. It seems more reasonable to be overinclusive and permit selection than underinclusive and require supplementation, from the viewpoint of both the instructor and the student.

Increasing interest and importance is being attached to food in its relation to health, and educational methods whereby this information is disseminated. That our educational program is effective is indicated by data presented by Dr. Sherman in *Nutrition Reviews*. Between 1915 and 1945 our national yearly per capita consumption of milk increased 52 per cent; of green and yellow vegetables, 79 per cent; and of citrus fruits and tomatoes, 133 per cent. As he puts it, we are "making people want the benefits which come from better food habits." We are moving toward the threefold goal set by the National Nutrition Conference of 1941—eradication of nutritional deficiency, reduction of infectious diseases, and "such levels of nutritional status for all as to ensure to each the degree of *health plus* that is potential in his hereditary birthright." Public opinion is making encouraging demands on producers and purveyors of food and educational and governmental agencies toward these ends.

In preparing this third edition, the authors have incorporated the suggestions of reviewers in so far as they were practical and nonconflicting with comments of others. The authors are grateful for constructive criticism and suggestions. Only through them can the book become more widely adaptable. And they are gratified by the kindly and encouraging support which the two previous editions have received.

ESTELLE E. HAWLEY
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PREFACE TO SECOND EDITION

Nutrition as a science is playing an increasingly important part in the world of today and will continue to do so in the world of tomorrow. Its value has been established as a weapon of war and as an instrument of peace. Its importance is not only a personal matter; it is national and international.

A friend expressed this widened scope when he wrote: "Food is exciting to me. I like to eat. I like to cook. And when to that is added the gargantuan opportunity to build a nation—a nation with greater health, greater desire for living, greater satisfaction from living, longer life, greater accomplishments from living—an opportunity to make a contribution to the whole scheme of things which nutrition can make—then it is exciting—and no end." The needs of the individual, however, must be studied in order to set the pattern for the nutrition of nations.

The material for this new edition has been brought up to date with the advances in nutrition research of the past two years. The newer knowledge of vitamins, the dietary standards recommended by the Committee on Foods and Nutrition of the National Research Council, and additional adjustments of the normal diet for abnormal conditions are included. Recent pertinent references have been added to the bibliography.

The outline for teaching diet therapy has been entirely revised and in order that the student may more readily follow the changes necessary, the tables dealing with diet adjustment relate directly back to the table showing the normal diet for the normal adult. Lists of supplies for the class work have been added to the laboratory outlines.

In the hope that it may help to stimulate the reader to the most serious consideration of good nutrition as a basis for good health, the authors present this second edition of The Art and Science of Nutrition.

ESTELLE E. HAWLEY
GRACE CARDEN

PREFACE TO FIRST EDITION

Recognition of the role which nutrition plays in clinical medicine is in no small measure due to Dr. James S. McLester's keen appreciation of the value of nutrition both in the prevention and in the

curative treatment of disease. He visualizes a sturdier, happier, more vigorous race, whose economic and cultural attainment will be greater and whose life span will be longer as the result of intelligent application of the newer knowledge of nutrition with which science has endowed us.

No longer is nutrition a mere matter of meal planning, based upon the meager knowledge or ability of the housewife. It is now a matter worthy of careful consideration and study by the medical profession and its ally, the nurse, in whose hands it often lies and upon whose intelligent cooperation so much depends. The nurse today must be trained to assume the detailed planning of diets and to know why and what adaptations are necessary in various disease conditions. The busy doctor seldom has time to do more than indicate the dietary treatment; he may even omit a request for diet adjustment. The nurse must, therefore, be able to prepare attractive, palatable, and nutritious meals which will tempt the appetite of her patient and at the same time take cognizance of the patient's metabolic dysfunction or need. Recovery from any condition of disease hinges in a large measure upon the nutritional status of the patient. One cannot hope to rebuild or sustain normal body tissue without adequate building material.

It is with realization of the paramount need for scientific knowledge of food and its uses, and of disease and its metabolic consequences, that we have here outlined the principles of normal nutrition and have indicated when, why, and how modification of the normal diet may be necessary. Space limitation prevents detailed discussion, but it is hoped that with the fundamentals of nutrition and diet adjustment as given here, and the reference material suggested, the nurse may acquire sufficient knowledge of nutrition as an art and as a science, to enable her to play her role in the betterment of human life.

Estelle E. Hawley
Grace Carden

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THE ART AND SCIENCE OF NUTRITION

PART I

NORMAL NUTRITION

CHAPTER I

NUTRITION AND ITS PLACE IN THE EVERYDAY WORLD

Some appreciation of the scope of the science of nutrition, its logical development, and the interrelationship between nutrition and the other biological sciences—chemistry, anatomy, physiology, endocrinology, and bacteriology—is desirable if one is to appreciate the fundamentals of this subject.

The anatomist, physiologist, and chemist, independently or in cooperation, labor to unravel the mysteries of the various phases of nutrition of the human body, of its internal secretions, of the vitamins and their functions, the effects of disproportion among the minerals, and the physiologic changes which follow drug administration. So science labors on and yields the fruit of its handiwork to the physician and to the nurse who in turn adapt the knowledge to the physical ills of man. Thus mankind ultimately reaps the benefits of the work of thousands of laboratory scientists.

Improvement of health and prevention of borderline diseases through diet adjustment are current problems. We are learning the difference between passable and buoyant health and are realizing that, to some extent at least, the choice is ours. The existence of a dietary deficiency is a serious matter. Inadequate diets exert a profound influence on the production of various borderline diseases, the symptoms of which are not always obvious. Dr. Barnett Sure, of the University of Arkansas, feels that failing health, in the adult particularly, may be the cumulative result of deficiencies in the diet covering a period of years. Today, with our general knowledge of the principles of nutrition, there is little excuse for inadequacy of diet, even on a limited income. Malnutrition is so often the result of ignorance in meal planning or food purchase or preparation rather than actual money lack. America can pro-

duce sufficient food if we learn to use it wisely. Excellent bulletins are available from the State Experiment Stations, State Colleges of Agriculture and Home Economics, and the United States Department of Agriculture. Several of the current "women's" magazines carry authentically instructive articles, some of the life insurance companies have prepared excellent material on food and health, a few of the commercial food manufacturers or promotors issue valuable leaflets which have the approval of the Committee on Foods of the American Medical Association, and recently nonadvertising radio talks on many subjects related to health have been promoted. We are fast accumulating knowledge as to the sources and properties of our various food products.

A food deficiency or ill-advised health program of any kind will decrease resistance and vigor. Health should be positive—not a mere absence of disease. We have learned that, for the healthy individual, when optimum intake of food essentials supplants maintenance allowance, increased vigor and joy in living result.

It has been said that "food in its broadest sense may be thought of as the total supply of beneficial materials which enter the organism from the outside" and that "the science of nutrition concerns itself first with the quantitative study of the sources and transformations of energy and secondly with certain qualitative factors of the food."

Through the ages man has survived in a large measure by his choice of foods, and today, in the light of our present knowledge, we realize how wisely, in general, he has chosen. Many food habits of primitive man can be shown to have scientific foundation. What more effective treatment could we use today for night blindness than that which Hippocrates used in the fifth century B.C., namely, the liver of the ox dipped in honey. Surely, if we have a panacea for many of our ills it might be found in liver, which, with the other organs, was routinely consumed by our ancestors. Whole grain cereals, grasses, and fruits are, and were in their natural state, ideal for the prevention of deficiencies. Decoctions of pine needles and herbs are rich mineral and vitamin sources. Through trial many cures were discovered; for example, by inclusion of a "lime" in the diet of sailors the English Navy was able to overcome

the scourge of scurvy which took such a heavy yearly toll of men. The story of the remarkable experiment of James Lind (1757), a surgeon in the English Navy, makes fascinating reading. Lind showed that of all the remedies tried, and he set up as well controlled an experiment as could be planned today, "lime juice" alone was effective. A similar story could be related of the Japanese sailors who developed beriberi on their diet of polished rice. Today we know why. The lime is a potent source of vitamin C. Polished rice lacked vitamin B_1.

Since the turn of the century, tremendous progress has been made in the understanding of food in its relation to health and disease. Doctors, dietitians, nurses, and the lay public are being given scientific instruction in nutrition. No longer does the physician hope to cure or control illness when a dietary deficiency or indiscretion persists. In certain conditions, as for instance anemia, diabetes, or celiac disease, diet is the real lifesaver. A food or nutritional history is as important as the clinical story. To the food-conscious clinician, the cure may be a simple matter of food adjustment. Food and food study no longer are limited to the homemaker and dependent upon her instincts. Nutrition has become one of the important sciences today.

With better selections of food products made possible by our modern methods of preservation and transportation, greater knowledge in the preparation of tasty dishes and education in the formation of wise food habits, appetite should no longer serve as the only guide in food selection. Counting calories is not enough. Certain basic food essentials must be included regularly in the diet. The "basic seven" has become a popular, valuable, and practical working outline.

The balance of life may even be in the hands of the housewife or nurse. A physician may or may not prescribe a dietary routine, but it is the homemaker or nurse who is ultimately responsible for the feeding of the family or the patient. Adequate meals may be planned, but if they do not appeal to the consumer from the standpoint of palatability, attractiveness, size of serving or consistency, they have little effectiveness. The planning of meals is an art as well as a science.

Since communities and nations are but large groups of individuals, feeding the masses becomes a matter of grave importance.

Economic prosperity can be reflected in the condition of the dinner table. No individual can work efficiently on an inadequate diet. The men of tomorrow will be no stronger than the children of today, whose growth is dependent upon their food intake. Food study is the job of every individual. Health is too precious to be missed by the failure to make what are sometimes simple adjustments in dietary habits. The stockman has long appreciated the need for careful supervision of the food and health habits of the animals under his care, for deficiencies are so easily demonstrated in animals. Shall we do less for human beings?

CHAPTER II

METABOLISM

Dr. Graham Lusk, one of the immortals of the science of nutrition, defined nutrition as "the sum of the processes concerned in the growth, maintenance and repair of the living body as a whole, or of its constituent organs." The word metabolism denotes the sum of the chemical changes of material under the influence of living cells. Two interdependent processes are included in the term metabolism, substance metabolism and energy metabolism.

Substance Metabolism

The first process, substance metabolism, is sometimes spoken of as anabolism. It is essentially synthetic, being the utilization by the body of the end products of digestion in *building body structure.*

Energy Metabolism

The second type of metabolism, energy metabolism, is analytical. It is sometimes called katabolism or catabolism. It is the process of *oxidation of foods by body tissues.* The end results of this process are the liberation of heat, maintenance of body temperature, production of energy for the performance of work, and, to a slight extent, the production of electrical currents. Possibly there are also some as yet unknown effects and results.

The French nobleman Lavoisier believed that it was perspiration which regulated heat loss from the body. To substantiate this idea, he constructed an apparatus to measure the heat given off by the body of a small animal in terms of the ice melted in a surrounding container. Today the energy metabolism of an animal or human being may be measured much more exactly by a calorimeter based on this early scheme. Lavoisier also realized that it was possible to measure the metabolism indirectly by analysis of expired air which contains the end products of the oxidative processes taking place within the body. The machines in common use today are based upon this latter conception.

Obviously, to measure the heat given off from the body necessitates the use of a definite heat unit. The accepted unit is the **calorie,** which is defined as the amount of heat necessary to raise 1 kilogram (2.2 pounds) of water 1° Centigrade, or 4 pounds of water 1° Fahrenheit. This calorie is sometimes called the large calorie to distinguish it from the small calorie, which is the heat necessary to raise 1 gram of water 1° Centigrade. Formerly the large calorie was distinguished from the small calorie by the use of a capital C. However, inasmuch as the small calorie is very rarely used, the term calorie with a small c is now used to indicate the large or kilogram calorie. Heat loss from the body can, therefore, be expressed in terms of calories. Since heat lost from the body must be compensated by available heat, which in turn arises from food, the requirement for food can likewise be expressed as calories.

The body is frequently likened to an engine which requires fuel for the performance of work, but unlike the engine the need for fuel never ceases in the body, although visible work is not being performed. Every movement of the body, whether voluntary or involuntary, is work. The winking of an eye, the beating of the heart, the secretion of the glands, the maintenance of muscular tone, are all work and require energy. At no time during life is it possible to prevent expenditure of energy, although it is possible greatly to reduce this expenditure by eliminating all voluntary movement. The voluntary movements which result from exercise, as one would expect, increase energy expenditure. The amount of the increase varies with the severity of the exercise. Unlike the engine, the body has the unique ability to grow, to repair itself, and within limits to manage its own resistance to infection or breakdown.

In addition to exercise, the energy expenditure of the body, or its metabolism, or its **metabolic rate,** is influenced by age. The rapidly growing child and the young adult have a higher metabolism than the older person or the aged. The firm-muscled athlete uses more fuel than the individual with flabby underdeveloped muscles. It has been reported that undernutrition reduces the metabolic rate as much as 12 per cent. A man, probably because he has more active tissue and less fat than a woman, in proportion to his actual weight, has a higher metabolic rate. Glandular disturbances, or conditions in which fever is present, likewise influence

metabolism. An approximate increase of 7 per cent in metabolic rate occurs for every degree Fahrenheit of increase in body temperature. Environmental temperature is another factor which requires body adjustment in order that the body temperature may be maintained at an approximately constant level, in spite of external temperature. Methods of attaining this end are increase in the muscular tone and shivering. Lastly, food itself, when eaten, increases heat production of the body in much the manner that fuel thrown into a furnace increases the heat output of the furnace.

Therefore, in **determining the food requirement** of an individual, the sex, age, physical condition, and the degree of activity must be considered in addition to size. It is possible, either by direct measurement of heat loss, or by indirect measurement through analysis of the respiratory gases, to determine the caloric expenditure or requirement, under a variety of conditions where different physical and mechanical factors are operative.

Basal Metabolism

Basal metabolism is the metabolism of the body at complete rest, in a comfortable position and comfortably warm and relaxed, both mentally and physically. The patient must also be in a post-absorptive state, i.e., the last meal must have been eaten twelve to eighteen hours previously. Since voluntary activity can be eliminated, and since such activity is extremely variable, metabolism is generally measured under basal conditions. In making such measurement, it is found that for the same age, sex and size, individuals produce surprisingly constant amounts of heat over the same time period if this heat is expressed on a basis of their surface area. As the result of many determinations on normal individuals, under carefully controlled conditions, we now have tables which may be used in comparing the results on any given individual against the standard, and thus we may determine whether the metabolic rate obtained is normal or abnormal. A value within the range ± 10 per cent of the average may be considered normal.

Basal metabolism as measured is not, however, the lowest level of heat production. Sleep produces a further lowering of from 10 to 13 per cent in the rate. The determination upon a sleeping individual is not practical, and, therefore, the minimum heat production under previously described conditions is considered basal.

TABLE 1

CALORIES PER SQUARE METER PER HOUR FOR PERSONS OF DIFFERENT AGE AND SEX

(DuBois Normal Standard Modified by Boothby, Berkson, and Dunn)

Standard values for calories per square meter per hour used at various ages as of last birthday in construction of nomogram

MALES		FEMALES	
AGE LAST BIRTHDAY YEARS	MEAN	AGE LAST BIRTHDAY YEARS	MEAN
6	53.00	6	50.62
7	52.45	6½	50.23
8	51.78	7	49.12
8½	51.20	7½	47.84
9	50.54	8	47.00
9½	49.42	8½	46.50
10	48.50	9-10	45.90
10½	47.71	11	45.26
11	47.18	11½	44.80
12	46.75	12	44.28
13-15	46.35	12½	43.58
16	45.72	13	42.90
16½	45.30	13½	42.10
17	44.80	14	41.45
17½	44.03	14½	40.74
18	43.25	15	40.10
18½	42.70	15½	39.40
19	42.43	16	38.85
19½	42.00	16½	38.30
20-21	41.43	17	37.82
22-23	40.82	17½	37.40
24-27	40.24	18-19	36.74
28-29	39.81	20-24	36.18
30-34	39.34	25-44	35.70
35-39	38.68	45-49	34.94
40-44	38.00	50-54	33.96
45-49	37.37	55-59	33.18
50-54	36.73	60-64	32.61
55-59	36.10	65-69	32.30
60-64	35.48		
65-69*	34.80*		
70-74	34.4		
75-79	34.0		
80-84	33.7		
85-89	33.3		
90-94	32.6		
95-99	32.3		
100-104	31.9		

*Obtained by extrapolation.

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Expression of Metabolic Rate

The metabolic rate may be expressed as calories per square meter of surface area per hour, or per twenty-four hours, which is the usual method in clinical and experimental studies. Likewise it may be expressed as calories per kilogram or per pound, either per hour or per twenty-four hours. In practical diet calculation the use of the weight unit is more common. Comparison on the basis of surface area is more accurate than comparison on a weight basis, since, simply expressed, if a body is to maintain a constant temperature, it must produce heat under basal conditions in proportion to the surface exposed to the surrounding environment (this is known as the law of surface area). The actual weight does not express this relationship so accurately.

That heat production is proportional to surface area, rather than to weight, is well demonstrated by Table 2.

TABLE 2

METABOLISM OF VARIOUS WARM-BLOODED ANIMALS

ANIMAL	WEIGHT IN KILOGRAMS	CAL./SQ. M./24 HR.
Horse	441.0	948
Pig	128.0	1,078
Man	64.3	1,042
Rabbit	2.3	776
Fowl	2.0	943
Mouse	0.018	1,188

While determination of surface area has no practical value for diet calculations, it is the unit used in experimental studies in standards of comparison of individuals and the basis on which clinical metabolic rates are expressed. Accordingly, the student of nutrition should appreciate its significance.

From experimental studies, Table 3 has been made available. If the height and weight are known, surface area may be read off directly from such a table.

Total or Supermetabolism

As soon as external or voluntary work is carried on, or food is taken, there is an increase in heat production above the basal level. This larger heat value is termed total or supermetabolism, in contrast to the basal level. Obviously, the food intake under

TABLE 3

SURFACE AREA VALUES CALCULATED FROM HEIGHT AND WEIGHT

Chart of DuBois (Sherman)

HT. IN CM.	WEIGHT IN KILOGRAMS 25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105
200							1.84	1.91	1.97	2.03	2.09	2.15	2.21	2.26	2.31	2.36	2.41
195						1.73	1.80	1.87	1.93	1.99	2.05	2.11	2.17	2.22	2.27	2.32	2.37
190				1.56	1.63	1.70	1.77	1.84	1.90	1.96	2.02	2.08	2.13	2.18	2.23	2.28	2.33
185				1.53	1.60	1.67	1.74	1.80	1.86	1.92	1.98	2.04	2.09	2.14	2.19	2.24	2.29
180				1.49	1.57	1.64	1.71	1.77	1.83	1.89	1.95	2.00	2.05	2.10	2.15	2.20	2.25
175	1.19	1.28	1.36	1.46	1.53	1.60	1.67	1.73	1.79	1.85	1.91	1.96	2.01	2.06	2.11	2.16	2.21
170	1.17	1.26	1.34	1.43	1.50	1.57	1.63	1.69	1.75	1.81	1.86	1.91	1.96	2.01	2.06	2.11	
165	1.14	1.23	1.31	1.40	1.47	1.54	1.60	1.66	1.72	1.78	1.83	1.88	1.93	1.98	2.03	2.07	
160	1.12	1.21	1.29	1.37	1.44	1.50	1.56	1.62	1.68	1.73	1.78	1.83	1.88	1.93	1.98		
155	1.09	1.18	1.26	1.33	1.40	1.46	1.52	1.58	1.64	1.69	1.74	1.79	1.84	1.89			
150	1.06	1.15	1.23	1.30	1.36	1.42	1.48	1.54	1.60	1.65	1.70	1.75	1.80				
145	1.03	1.12	1.20	1.27	1.33	1.39	1.45	1.51	1.56	1.61	1.66	1.71					
140	1.00	1.09	1.17	1.24	1.30	1.36	1.42	1.47	1.52	1.57							
135	0.97	1.06	1.14	1.20	1.26	1.32	1.38	1.43	1.48								
130	0.95	1.04	1.11	1.17	1.23	1.29	1.35	1.40									
125	0.93	1.01	1.08	1.14	1.20	1.26	1.31	1.36									
120	0.91	0.98	1.04	1.10	1.16	1.22	1.27										

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Using the height and weight one reads across and down the columns and obtains the surface area.

normal conditions of life and activity must be sufficient to cover the total expenditure. These effects are well illustrated in many tables.

The total daily energy requirement of the child is summarized in Table 4, compiled by Lucy H. Gillett from data on the actual

TABLE 4

ENERGY REQUIREMENTS OF HEALTHY CHILDREN PER 24 HOURS

AGE	CALORIES	
	BOY	GIRL
1	900-1,200	800-1,200
2	1,100-1,300	1,000-1,250
3	1,100-1,400	1,150-1,350
4	1,200-1,500	1,050-1,450
5	1,300-1,600	1,200-1,500
6	1,500-1,900	1,450-1,800
7	1,600-2,100	1,500-1,900
8	1,700-2,300	1,600-2,200
9	1,900-2,500	1,800-2,500
10	2,100-2,700	1,900-2,600
11	2,100-2,800	2,000-2,800
12	2,300-3,000	2,100-3,000
13	2,500-3,500	2,300-3,400
14	2,600-3,800	2,400-3,000
15	2,700-4,000	2,400-2,800
16	2,700-4,000	2,250-2,800
17	2,800-4,800	2,250-2,800

TABLE 5

EFFECT OF ACTIVITY ON ENERGY EXPENDITURE

OCCUPATION	EXPENDITURE
Basal	40.86 calories per hour
Basal	0.68 calories per minute
Sitting	1.04 calories per minute
Standing	1.23 calories per minute
Walking	2.52 calories per minute
Running	5.24 calories per minute
Football	7.32 calories per minute
Gymnastics, etc.	2.53 calories per minute
Quad, games, etc.	3.12 calories per minute
Outdoor work, heavy, etc.	3.31 calories per minute
Outdoor work summer, etc.	3.54 calories per minute
Gardening	2.39 calories per minute
Workshop	2.07 calories per minute
Swim	5.93 calories per minute
Cold bath	3.93 calories per minute
Dressing	1.83 calories per minute
Bed making, etc.	2.42 calories per minute
Siesta	1.09 calories per minute
Odds and ends, waiting about	1.80 calories per minute
Violin practice	1.25 calories per minute

food consumption of 223 healthy children and published in *Food Allowances for Healthy Children.**

The **effect of activity** is well demonstrated in a complete study of energy expenditure at different forms of activity by E. M. Bedale (Proc. Roy. Soc., London **94**: 368, 1923) and quoted in the White House Conference report on nutrition. The study was made on 45 boys and 45 girls, ranging in age from 8 to 18 years, but divided according to height, weight, and general physical capacity, regardless of age, into groups averaging 10 children each. The values obtained on one group are sufficient to demonstrate the effect. This group was composed of boys of an average age of 15¾ years, average height of 164 centimeters, and average weight of 50.1 kilograms. See Table 5.

Metabolism Measurement

As has been mentioned, several types of apparatus are available for the measurement of metabolism. Fig. 1 illustrates one of the clinical machines, designed for office and bedside use, which measure the oxygen consumption over a given period of time

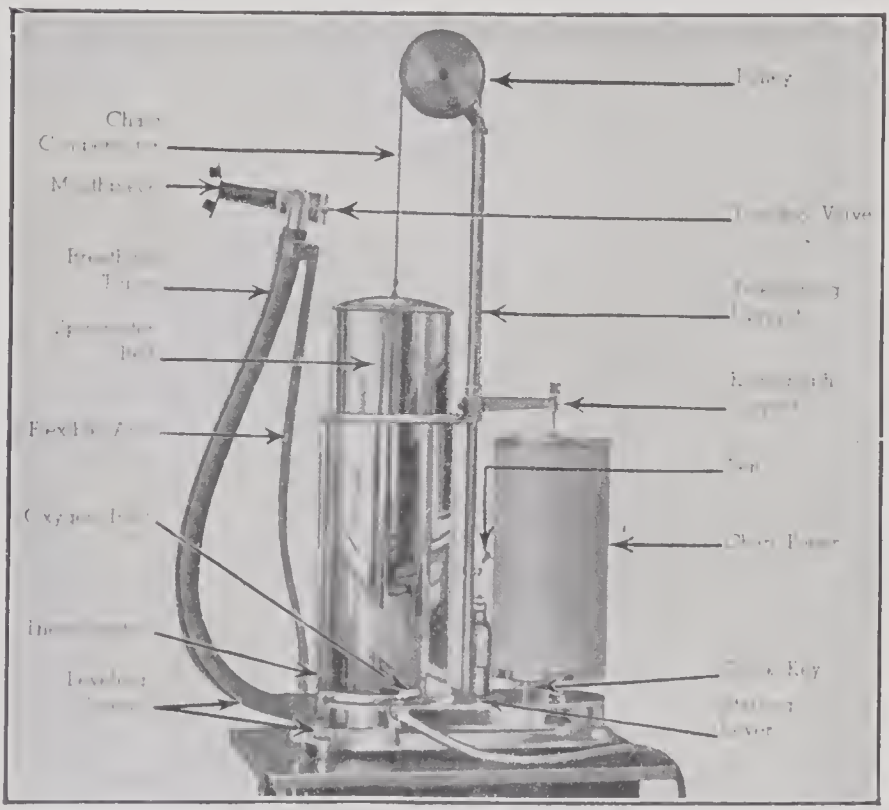

Fig. 1.—The Benedict-Roth metabolism apparatus. (Courtesy of Warren E. Collins, Inc., Boston.)

*Bureau of Food Supply Bulletin No. 115, Association for Improving the Condition of the Poor, New York City, 1917.

by the fall of a spirometer bell, previously filled with oxygen. The subject is part of the circuit. Many other models are available and are equally as satisfactory as the one illustrated here. The metabolic rate is calculated from the volume of oxygen consumed in a given time period under "basal" conditions. The heat value is obtained "indirectly"—the oxygen consumption represents the extent of oxidation which has taken place within of the body during the test period. Fig. 2 illustrates the mechanics of this action.

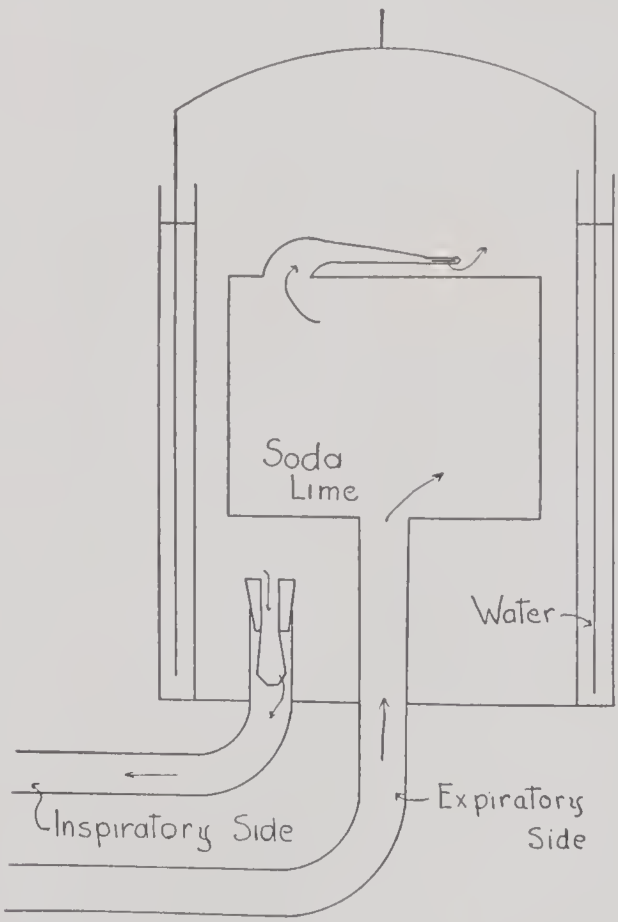

Fig. 2.—Diagram of the connections in the spirometer of the Benedict-Roth apparatus. (From Bard: *Macleod's Physiology in Modern Medicine*, The C. V. Mosby Co.)

Comparison of the metabolic rate value obtained on the patient can be made with standard values (Table 1). Deviation from these standards by more than plus or minus 10 per cent indicates altered metabolic activity. Detection of glandular abnormality is the usual reason for this test.

By means of more technically accurate metabolism machines, those which measure both CO_2 and O_2, it is possible to determine exactly the energy expenditure in the performance of various

Table 6

Total Energy Expenditure per Hour Under Different Conditions of Muscular Activity

FORM OF ACTIVITY	CALORIES PER HOUR			
	MAN		WOMAN	
	PER KILOGRAM	PER POUND	PER KILOGRAM	PER POUND
Sleeping	0.93	0.43	0.87	0.40
Awake, lying still (basal metabolism)	1.10	0.50	1.02	0.47
Sitting quietly	1.43	0.65	1.33	0.60
Reading aloud	1.50	0.69	1.39	0.63
Standing relaxed	1.50	0.69	1.39	0.63
Hand sewing[1]	1.59	0.72	1.47	0.67
Standing at attention	1.63	0.74	1.53	0.69
Knitting (23 stitches per min. on sweater)	1.66	0.75	1.54	0.70
Dressing and undressing	1.69	0.77	1.57	0.71
Singing	1.74	0.79	1.62	0.74
Tailoring	1.93	0.88	1.79	0.81
Typewriting rapidly	2.00	0.91	1.86	0.85
Ironing (with 5 lb. iron)	2.06	0.93	1.91	0.87
Dishwashing (plates, bowls, cups, and saucers)	2.06	0.93	1.91	0.87
Sweeping bare floor (38 strokes per min.)	2.41	1.09	2.24	1.02
Bookbinding	2.43	1.10	2.26	1.02
"Light exercise"[2]	2.43	1.10	2.26	1.02
Shoemaking	2.57	1.17	2.41	1.10
Laundry work (towels rubbed on a board without water, 35 times per min.)	2.60	1.18	2.42	1.10
Walking slowly (2.6 miles per hr.)	2.86	1.30	2.66	1.21
Carpentry, metal working, industrial printing	3.43	1.56	3.19	1.45
"Active exercise"[3]	4.14	1.88	3.85	1.75
Walking moderately fast (3.75 miles per hr.)	4.28	1.95	3.99	1.81
Stoneworking	5.71	2.60	5.31	2.41
"Severe exercise"[4]	6.43	2.92	5.98	2.72
Sawing wood	6.86	3.12	6.39	2.90
Swimming	7.14	3.25	6.64	3.02
Running (5.3 mi. per hour)	8.14	3.70	7.57	3.44
"Very severe exercise"[5]	8.57	3.90	7.97	3.62
Walking very fast (5.3 mi. per hr.)	9.28	4.22	8.63	3.92

From Rose, Mary Swartz: *A Laboratory Handbook for Dietetics;* copyright, 1937, by The Macmillan Company and used with their permission.

The data in this table include the basal metabolism and the influence of food.

The average man is considered to weigh 70 kilograms, or 154 pounds; the average woman, 56 kilograms, or 124 pounds.

[1]Eating, office work, routine classwork, dressing and undressing, etc.

[2]Includes all light housework, laboratory work, clerking, running sewing machine, routine nursing, automobile driving, etc.

[3]Consists of such activities as washing, sweeping, scrubbing, carpentry, shopwork, brisk walking, rowing, paddling, etc.

[4]Expresses activity of most sports, such as tennis, ordinary gym work, basketball, baseball, swimming, farm work in general, truckman's work, etc.

[5]That of a lumberman, freight handler, miner, boxer, or wrestler, or one who works in extreme cold, etc.

tasks. The subject may be connected to the circuit in the same manner as in the clinical test. He may work in a "respiratory chamber," a large box or room, which is inserted into the circuit, or small sampling bags may be hung onto his back, and, as work is performed these may be removed as desired and taken to the laboratory for later analysis of the expired air. Or, again, the subject may be inside of a chamber through which circulating water is carried in coils. The increase in water temperature represents the heat given off from the subject's body. The metabolic rate is thus directly measured.

Such machines are too costly and difficult of operation for clinical use, but only when both the CO_2 and O_2 are measured are the data sufficiently accurate for research purposes. From such research a large amount of data are available, some of which is presented in Table 6.

Specific Dynamic Action

The effect of food to increase metabolism over the basal level was called "specific dynamic action" (sometimes spoken of as S.D.A.) by Rubner. Any food ingested in excess of that needed for immemediate energy or structural purposes exerts this effect. The feeding of pure foodstuffs indicates that the increase from each is not identical. Roughly, the increase resulting from protein is 30 to 40 per cent, from fat 4 to 14 per cent, and from carbohydrate 5 to 7 per cent. On the average, food causes an increase of some 10 per cent above the basal level. The explanation of this dynamic action is complicated. Lusk stated that it is produced during the utilization of the food products by the body. It has been called "the cost of digestion." This factor must be calculated and added to the basal metabolism of work if total metabolism is to be determined.

Calculation of Calories

When the total metabolic requirement has been determined, it is obvious that if weight is to be maintained, the food ingested must supply a sufficient number of calories to meet this requirement. In the absence of sufficient fuel in the form of food, the body tissues are consumed to meet the deficit. When food energy is less than expenditure over a given time, weight is lost; conversely, when food intake is in excess of the energy expenditure, this excess is stored as body fat and weight is gained.

It is possible to balance intake and outgo by the use of knowledge gained from experimental work on requirements of the body and the fuel value of foods.

Fuel Value of Foods

The combustion heat value of a food may be determined by burning it (or any other substance desired) in a bomb calorimeter in an atmosphere of pure oxygen. The heat evolved is measured

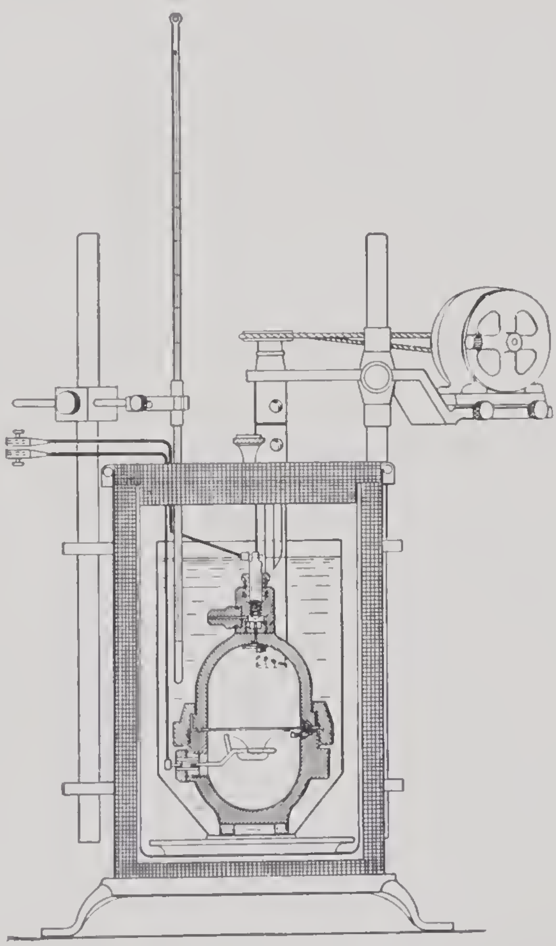

Fig. 3.—Cross section of Emerson fuel calorimeter. (Courtesy of Emerson Apparatus Co., Melrose, Mass.)

as a change in temperature of the water surrounding the "bomb." Such determinations indicate:

1 gm. of pure fat yields 9.3 calories
1 gm. of pure carbohydrate yields 4.1 calories
1 gm. of pure protein yields 4.1 calories

or 9, 4, and 4 calories, respectively. Fat and carbohydrate, having the structure C(arbon), H(ydrogen), O(xygen), are burned com-

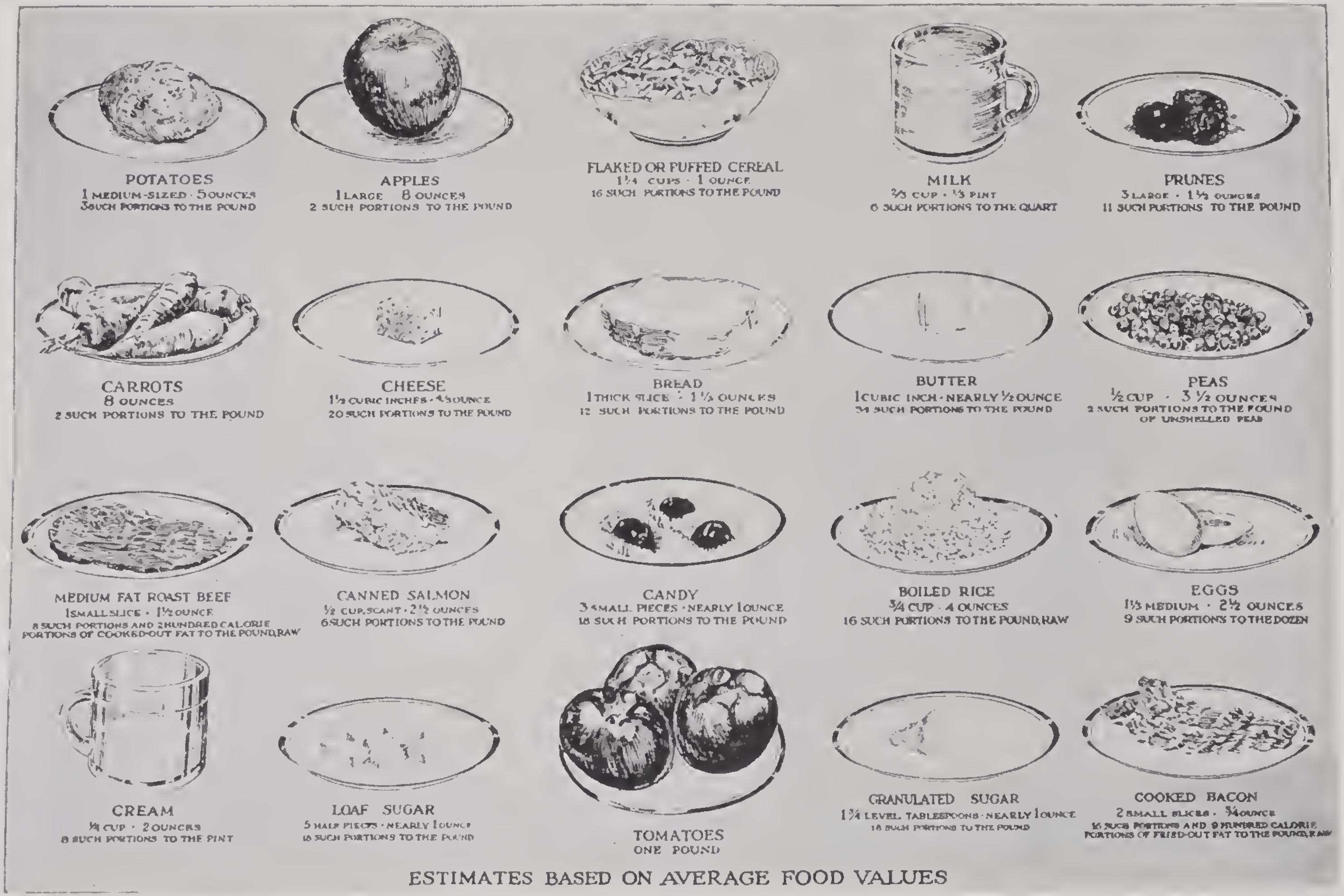

Fig. 4.—One-hundred-calorie portions of a few familiar foods in terms of ordinary household measurements and of quantities commonly purchased. (Courtesy of the Bureau of Home Economics, United States Department of Agriculture.)

pletely to carbon dioxide and water. Protein, with the structure C H O N(itrogen) P(hosphorus) S(ulfur), yields in addition to carbon dioxide and water, a residue, and when correction is made for this incomplete combustion, the average value for proteins becomes 4.1 calories per gram.

Knowing the chemical composition of a food, and these fuel values, the energy value of the food may be calculated; for example, milk.

Carbohydrate	5%	(5 gm. per 100) × 4 =	20 calories
Fat	4%	(4 gm. per 100) × 9 =	36 calories
Protein	3.3%	(3.3 gm. per 100) × 4 =	13 calories
			69 calories per 100 gm.

If 100 gm. yield 69 calories, approximately ⅝ cup or 147 gm. will yield 100 calories.

By such calculations, and by actual burning of foods in the bomb calorimeter, tables of food values have been prepared. This energy value of foods may be expressed as the amount necessary to yield 100 calories (the 100 calorie portion) (Fig. 4), the amount yielded by 100 gm. of food (detailed table in appendix), or the calorie yield in the "average" or "standard portion." This information is expressed as E. P. (edible portion) or as A. P. (as purchased).

Calculation of Energy Requirement

Calorie intake may, therefore, be adjusted to bring about weight loss, maintenance, or weight increase. To "count calories" is the first step in the adjustment of diet, as will be seen later under a discussion of diet planning.

Since, as a result of scientific investigation, average values have been obtained for the energy expenditure while perform-

Table 7

Calculation of Energy Requirement

Sleeping	8 hr.	×	0.93 calories	=	7.4 calories
Light exercise	8 hr.	×	2.43	=	19.4
Active exercise	2 hr.	×	4.14	=	8.3
Sitting quietly	6 hr.	×	1.43	=	8.6
					43.7

43.7 cal./ kg. × 60 kg. = 2,622 calories

Correction for age can be approximated by reference to the Atwater conversion factors (Table 8).

ing various tasks (Table 6), it becomes possible to ascertain the approximate caloric requirement for a given individual by using these values in conjunction with an outline of activity. For example, the caloric requirements of an individual weighing 60 kilograms are given in Table 7.

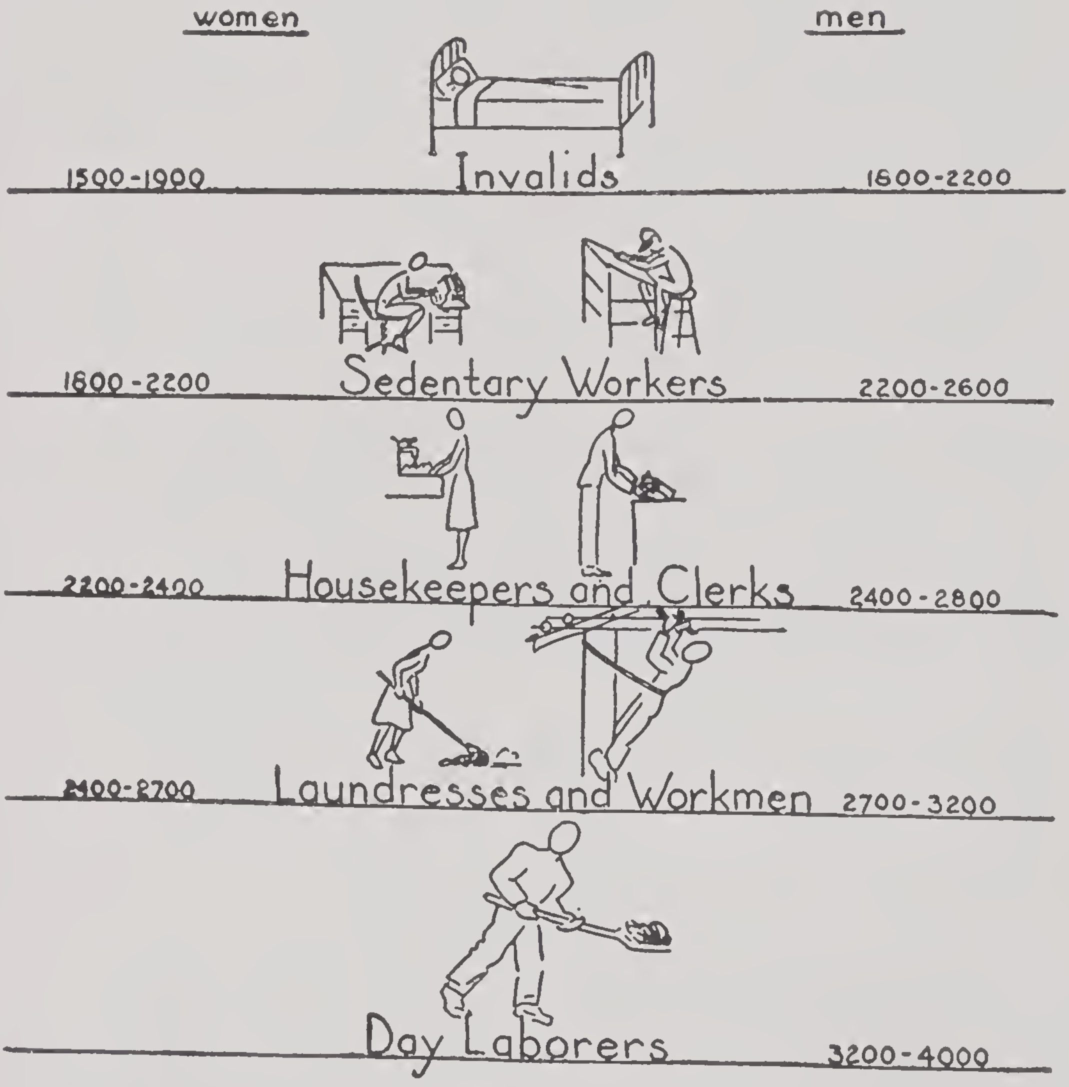

Fig. 5.—Summary of calorie needs for daily activities. (From Roundtree: *This Question of Foods*, published by the Public Affairs Committee, New York City.)

Such calculation is also sometimes made by assuming a 35-40 calorie requirement per kilo per day for an individual whose occupation does not include unusual activity (40 × 70 = 2800 calories) and a kilo requirement up to 50 calories as physical exertion increases (50 × 70 = 3500) or down to 25-30 when an individual is inactive or during bed rest (2000 ±). Again 40 calories per inch of height is an approximate need for one performing

light physical tasks—up to an allowance of 50 calories as activity increases; for example; a 6 foot man will require from 2,880 to 3,600 calories.

TABLE 8

CONVERSION FACTORS FOR CALCULATION OF ENERGY REQUIREMENT FOR PERSONS OF DIFFERENT AGE AND SEX

INDIVIDUAL	AGE IN YEARS	FACTOR	AVERAGE TOTAL CALORIES FOR 24 HOURS
Man		1.0	3,000
Boy	15-16	0.9	2,700
Woman		0.8	2,400
Girl	15-16	0.8	2,400
Boy	13-14	0.8	2,400
Girl	13-14	0.7	2,100
Boy	12	0.7	2,100
Girl	10-12	0.6	1,800
Boy	10-12	0.6	1,800
Child	6- 9	0.5	1,500
Child	2- 5	0.4	1,200
Child	under 2	0.3	900

The average of values obtained the world over for normal individuals of moderate activity indicates that the daily food requirement approximates 2,500 calories for women and 3,000 calories for men.

Summarizing, according to occupation, the figures of Tigerstedt may be adapted as indicated in Fig. 5.

TABLE 9

SUMMARY OF APPROXIMATE ENERGY REQUIREMENTS AT DIFFERENT AGE LEVELS

1-6 months	110-120 calories
6-12 months	100-110 calories
1st year	95-100 calories
1-2 years	90-100 calories
2-5 years	80-90 calories
6-9 years	70-80 calories
10-13 years	
Girls	60-70 calories
Boys	65-75 calories
14-17 years	
Girls	40-60 calories
Boys	50-65 calories
Adult (male)	35-60 calories
Adult (female)	30-60 calories
Light exercise	30-40 calories
Moderate exercise	40-50 calories
Heavy exercise	50-60 calories
Bed rest	30-35 calories
Old age	30-40 calories
Basal requirement	approx. 25 calories

There is an average increase above the basal of 50 per cent for light work, 75 per cent for moderate work, and 100 per cent for heavy work.

Expressed on the basis of calorie requirement per kilogram of body weight for a 24-hour period, average values at different age levels are listed in Table 9.

Metabolic activity is greatest during the period of structural growth. It reaches a plateau during adult life and gradually decreases with old age.

TABLE 10

METABOLISM

Measurement of the energy expenditure of the body:
- A. As basal expenditure or as total expenditure
  1. Basal measurement—the B.M.R. (basal metabolic rate)—the "cost of life"
     - a. Expressed as calories per kilogram, per pound or per square meter, on hourly or 24-hour basis
     - b. Influenced by sex, age, climate, physical condition, and previous diet
     - c. Conditions of measurement, postabsorptive (18 hours after food) warm, comfortable, and relaxed
  2. Supermetabolism or total metabolism; the sum of the basal, the effect of food, the amount produced by means of activity plus the energy loss in the excreta
- B. How measured?
  - a. From the oxygen consumption in a clinical machine
  - b. More exactly by determination of both oxygen consumption and carbon dioxide output
  - c. By direct measurement of heat given off by the body

Review Questions

What does the term metabolism denote?

What is substance metabolism? Energy metabolism?

What unit of heat is used to measure the heat production of the body?

This unit is how defined?

What is basal metabolism?

What factors affect the metabolic rate?

What factor has the greatest influence in raising the metabolism above the basal rate?

In what two ways may the metabolic rate be expressed?

Of the two, which is the more accurate? Why?

In practical diet calculation, which method is used?

What types of apparatus are used to measure metabolism?

Why should food intake balance metabolic requirement?

How is the fuel value of foods measured?

What is the average daily food requirement in terms of calories for men? For women?

CHAPTER III

CLASSIFICATION AND FUNCTION OF FOODS

How is it possible to plan a dietary and be sure of its adequacy? How do we know the basic needs of the body?

If we look at the composition of the human body and then at the composition of available foods, it is evident that it is entirely possible to replace the building blocks or chemical elements of which the body is constructed with the corresponding elements occurring in foods. This knowledge enables us to choose wisely in order to prevent a shortage of any of the essential structural units. The chemical analysis of the body is worth quoting, its relative worthlessness in dollars and cents is apparent. At the current price of chemicals, the body's store is worth something less than two dollars.

TABLE 11

COMPOSITION OF THE BODY

		PER CENT			PER CENT
O	Oxygen	65	Fe	Iron	0.004
C	Carbon	18	Mn	Manganese	0.0003
H	Hydrogen	10	I	Iodine	0.00004
N	Nitrogen	3	Cu	Copper	Very minute trace
Ca	Calcium	1.5	Zn	Zinc	Very minute trace
P	Phosphorus	1.0	Si	Silicon	Very minute trace
S	Sulfur	0.25	Al	Aluminum	Very minute trace
Na	Sodium	0.15	F	Fluorine	Very minute trace
Cl	Chlorine	0.15	Others		Very minute trace
Mg	Magnesium	0.05			

Food is the only source of structural or repair material available to the body. It is the only source of the regulating materials or "oil" which bring about smooth effective function, and it is the only source of the energy required for the performance of work (activity). It is essential, therefore, that we choose foods which will supply these materials if the proper balance between wear and repair is to be maintained.

As the result of chemical analyses similar foods may be grouped according to chemical composition into classes. Such grouping is

known as the classification of food. Details will be found under specific foodstuff discussions.

Proteins: Organic compounds (compounds having once lived or grown), composed of C, H, O, N, S, sometimes P and other elements. The ultimate cleavage products resulting from digestion, and the building blocks of animal tissues are the amino acids which are C-H-O-N or C-H-O-N-S compounds. No other foodstuffs yield this group. Therefore, protein is necessary for structural purposes. It can, in addition, be utilized as fuel if part of the molecule is oxidized to CO_2 and H_2O; the balance is then excreted by the kidneys.

Sources: Complete proteins—animal products as milk, egg, meat, fish and cheese. Gelatin is an exception. Incomplete proteins—vegetable proteins as legumes, cereals, and cereal products. Again several exceptions occur which will be pointed out later.

Digestion: Digestion takes place both in the stomach and in the intestinal tract under the influence of gastric pepsin, pancreatic trypsin, and intestinal erepsin.

Fuel value: 4 calories per gram.

Fats: Organic compounds of C, H, O. These are fuel foods, oxidized in the body to CO_2 and H_2O with the liberation of energy. The fats are also carriers of the fat-soluble vitamins and essential fatty acids.

Sources: Animal and vegetable—butter, cream, cheese, animal fats, cottonseed oil, corn, wheat-germ oils, margarines and nuts.

Digestion: Emulsified in stomach by gastric lipase, reduced to fatty acids and glycerol by the pancreatic lipase, and rendered water soluble through the action of the bile salts.

Fuel value: 9 calories per gram.

Carbohydrates: Organic compounds composed of C, H, O—fuel foods which are also burned to CO_2 and H_2O with the liberation of energy.

Sources: Vegetables, cereals, fruits, sugars, and starches. The ratio between C-H-O differs from that in fat, thereby producing a different substance.

Digestion: Digestion begins in the mouth with salivary ptyalin, is halted somewhat in the stomach, and continues again by the amylopsin of the pancreatic juice and the intestinal group maltase, sucrase, and lactase. The end result is the simple sugars.

Fuel value: 4 calories per gram.

In addition to the organic compounds used for body structure, and as sources of energy, foods contain water, mineral salts, and vitamins, all of which are essential both for body building and for normal body function (see specific discussions).

Very rarely are foods composed of a single constituent. Sugar, which is pure carbohydrate, egg white and dry gelatin which are pure protein, and olive oil, cottonseed oil, and some other oils which are pure fat, are exceptions. In general, all the several constituents are present in a food, but in varying amounts. A food may be said to belong to a certain group only if that nutrient is present to such an extent that, when the food is eaten in normal servings, appreciable amounts of protein, fat, or carbohydrate are obtained, or when one of the components of that particular food has greater nutritional importance than the other components. For example,

TABLE 12

THE FUNCTIONS OF FOOD IN NUTRITION

Function	*Classification*		*Foods*
Furnish energy	Carbohydrates	Sugars	Sugars, Syrups, Molasses
		Starches	Flour and flour products, Bread, Crackers, Cereals, Potatoes, Other starchy vegetables
	Fats		Butter, Lard and lard substitutes, Oleomargarine, Meat fats, Bacon, Oils, Nuts, Cheese, Cream
Build and repair the body	Proteins for muscles		Variety meats, Meat, Fowl, Fish, Soybeans, Milk, Eggs, Cheese, Legumes, Bread and cereals, Nuts
	Minerals	Calcium for bones and teeth	Milk, Cheese, Vegetables (greens)
		Phosphorus for bones and teeth	Variety meats, Meat, Fowl, Fish, Soybeans, Milk, Cheese, Legumes, Eggs, Whole grain bread and cereals
		Iron for blood	Variety meats, Oysters, Meat, Vegetables (greens), Legumes, Fowl, Potatoes, Dried fruits, Eggs, Fish, Whole grain or enriched bread and cereals
Regulate body processes	Vitamins	A	Fish liver oils, Liver and kidney, Vegetables (green and yellow), Fruits (yellow), Tomatoes, Butter, Oleomargarine (fortified), Cream, Cheese, Egg yolk
		B — Thiamine (B_1)	Pork, Variety meats, Soybeans, Meat, Oysters, Melons, Potatoes, Milk, Whole grain or enriched bread and cereals, Vegetables (greens), Fowl
		B — Riboflavin (B_2)	Variety meats, Soybeans, Milk, Oysters, Vegetables (greens), Meat, Eggs, Fowl
		B — Niacin (Nicotinic Acid)	Variety meats, Meat, Fowl, Fish, Peanut butter, Potatoes, Whole grain or enriched bread and cereals
		C	Citrus fruits, Melons, Berries, Other fruits, Tomatoes, Vegetables (especially raw)
		D	Fish liver oil, Fat fish, Liver, Milk (fortified), Eggs, Irradiated foods, Sunshine

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milk is classed as a protein food, although its composition is 87 per cent water, 5 per cent carbohydrate, 3.3 per cent protein, and 4 per cent fat. The protein of milk is of high biological value, is readily digested, and when milk is taken in normal amounts it is an important source of protein. Other foods could just as satisfactorily be used to supply carbohydrate or fat.

Review Questions

Why can food nourish the body?

Name the three oxidizable food nutrients.

What results from their oxidation within the body?

What other constituents are found in food in addition to these three organic compounds?

CHAPTER IV

THE PROTEINS

It is logical to begin a discussion of the foodstuffs necessary for the maintenance of life with the subject protein. The word has a Greek derivation, and means to come first. Protein does come first, since every living cell contains and must have a continuous supply of protein if its life is to be maintained. Protein forms a large part of the solid matter of animal tissue (15 to 20 per cent). In the plant kingdom, while protein occurs less abundantly than does carbohydrate, it still is an important constituent. In fact, it is the plant which supplies the original source of the animal protein. The plant, in some manner peculiar to itself, combines carbohydrates (which it synthesizes from carbon dioxide and water under the influence of sunlight) with ammonia or nitrogenous compounds in the soil, to form protein. While animals can rebuild protein in their tissues, they cannot produce it from simple inorganic, innate substances which have never lived. Through the ingestion of vegetable proteins, animal tissues are formed. Roughly, 10 pounds of vegetable protein are required for the construction of 1 pound of animal protein. Through the ingestion of animal and vegetable proteins, man is able to build his body structure. While protein, as can be seen from its constituents, serves as a source of energy, its chief function is to supply the tissue-building material. Chemically, protein is a complex organic substance, containing carbon, hydrogen, nitrogen, oxygen, and sulfur. Some proteins also contain phosphorus and other elements.

Protein is broken down in the process of digestion into its structural units, the amino acids. These amino acids are carried in the blood stream to all parts of the body. The individual body cells are thus enabled to pick from this supply the particular amino acids necessary for growth, repair, formation of new tissue, including enzymes, hormones, hemoglobin, antibodies. The process may be likened to the building up of various words by selection and combinations of the individual letters of the alphabet. A molecule of protein may combine as many

as several hundred individual amino acids. Countless combinations are possible. The amino acids not immediately utilized for structural purposes, or to a slight extent stored as reserve protein, are broken down. The nitrogen fraction is split off, converted into urea, and eliminated in the urine. The non-nitrogenous fraction is oxidized to CO_2 and O_2 to yield energy or is changed into body fat and stored.

Certain of these amino acids (22 are known to exist) must be supplied preformed to the body by way of the ingested food. The others can be synthesized one from another within the body itself. They are accordingly divided into two groups: **dispensable,** or nonessential, and **indispensable,** or essential. Any food containing all of the essential amino acids is known as a complete, adequate, or class A protein, a *protein of high biological value.* If the food contains many amino acids, but not all of the essential ones, it is called an incomplete, inadequate, or a class B protein. Obviously, this latter group of proteins cannot alone maintain normal growth or weight, permit reproduction, or produce good health. **Animal proteins,** such as milk, eggs, cheese, meat, and fish, have "high biological value." They are complete proteins. Gelatin is the exception, it is not a complete protein for it lacks three essential amino acids—valine, tryptophane, and isoleucine.

Dr. W. C. Rose, a leading authority on the amino acids, lists them as given in Table 13.

TABLE 13

DISPENSABLE	INDISPENSABLE
Alanine	Arginine
Aspartic acid	Histidine
Citrulline	Isoleucine
Cystine	Leucine
Glutamic acid	Lysine
Hydroxyglutamic acid	Methionine
Glycine	Phenylalanine
Norleucine	Threonine
Proline	Tryptophane
Hydroxyproline	Valine
Serine	
Tyrosine	

The **cereal and vegetable proteins** have a lower biological value, i.e., they lack some of the important amino acids, and alone they

cannot support growth. Vegetable proteins, such as the legumes (beans, peas, lentils, and peanuts), are sometimes called "poor man's meat" because the protein of these foods can satisfactorily supplement the animal group. By the inclusion of these proteins in the diet, the animal proteins (always more costly in dollars and cents) may be decreased in amount.

A food may contain all of the essential amino acids and still have low biological value. If some of the essential acids are present in small amounts, obviously large quantities of the food must be consumed in order to assure adequacy. Such a food is excellent to supplement other proteins but not practicable as the only one. Soybeans belong to this class. Further information as to quantitative relationship between the essential amino acids in food products will be continuously forthcoming. Research programs are resulting in data regarding quantitative need for the various amino acids and the amino acid content of foods.* Perhaps it soon will be possible to chart the amino acids as we do the vitamins and minerals, indicating need, deficiency signs, and sources. Information on the content of food will result in the ability to *supplement* proteins, combine them, or enrich them in such a manner that the essential amino acid content is made adequate. This will bring about a lowering of the cost of protein food.

The effectiveness of proteins is determined by animal-feeding experiments. For example: Osborne and Mendel showed that if rats were given casein (protein of milk) as the only protein in an otherwise adequate diet, they grew satisfactorily. If the casein was replaced by gliadin (one of the proteins of wheat), the animals were able to maintain their weight but did not grow. When zein, one of the proteins of corn, replaced the casein, the animals lost weight and died. Zein lacks the amino acids, lysine and tryptophane. Gliadin contains but small amounts of lysine. A protein capable of maintaining life but not inducing growth is said to be partially complete in contrast to complete and incomplete proteins.

Recent reports have shown that tryptophane deficiency, for example, results in loss of weight, alopecia (baldness), cataract formation, corneal vascularization, defective dentition, atrophy of

*In April, 1949, Dr. Rose announced that arginine and histidine were essential for rats but not for human beings. He also presented quantitative amounts of the essential acids necessary for nitrogen balance in adult males.

the testicles, hypoproteinemia, and hypochromic anemia, and that it is an important dietary essential for normal reproduction in rats.

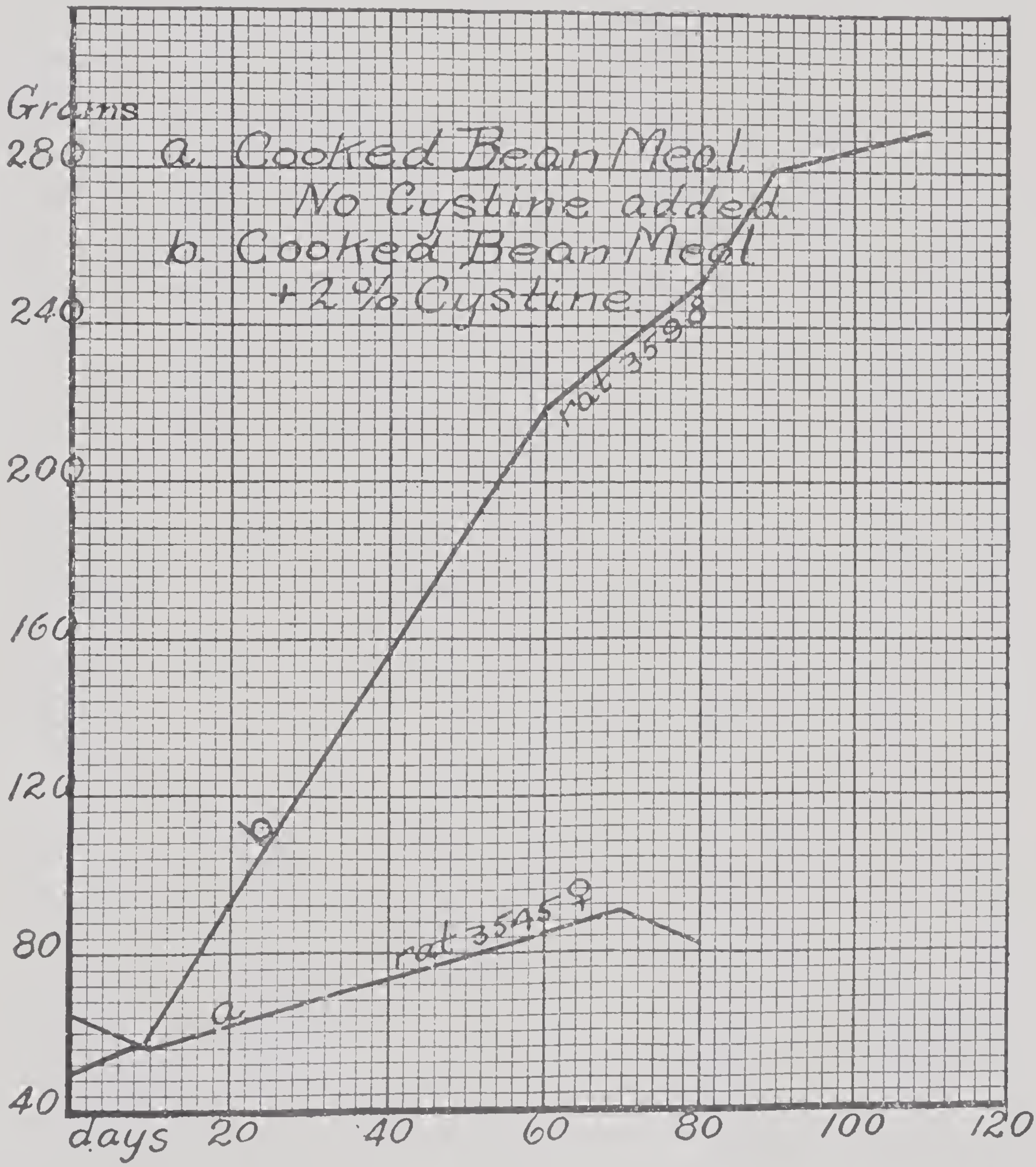


Fig. 6.—Curve of two rats on the experiment to determine the food value of navy bean meal, showing influence of a deficiency of cystine in the diet. It is now known that methionine rather than cystine is the essential S containing amino acid. (From Johns and Finks: J. Biol. Chem. 41: 379, 1920.)

The **chemical structure** of protein differs from both carbohydrate and fat in that besides carbon, hydrogen, and oxygen, protein contains nitrogen and sulfur, and sometimes phosphorus and other elements. The presence of carbon, hydrogen, and oxygen indicates that protein can yield energy and be burned to carbon dioxide,

water, and a residue. This is costly energy, however, since the proteins form the most expensive food group. Therefore, in diet-planning sufficient protein should be included to assure adequate growth and repair but, if cost is a factor, with little extra to be burned.

Proteins may be classified according to their composition and physical characteristics.

1. **Simple proteins** yield amino acids or their derivatives upon hydrolysis. Simple proteins may be subdivided into a number of groups, but only two groups need mentioning here; the albumins to which belong egg albumin and serum albumin (blood), leucosin of wheat, legumelin of peas; and the globulins, examples of which include serum globulin, muscle globulin, edestin of wheat, and legumin of beans and peas.
2. **Conjugated proteins** are substances which contain the protein molecule united to some other molecule. Examples are the nucleoproteins found in thymus gland and wheat germ, which contain nucleic acid; the glycoproteins containing carbohydrate (the mucins); the phosphoproteins containing phosphorus—caseinogen (milk), ovovitellin (egg yolk); and the hemoglobins, which contain hematin, for example, the hemoglobin of blood.
3. **Derived proteins** are products resulting from partial hydrolysis. They include: proteans, metaproteins, coagulated proteins, proteoses, peptones, and peptides.

While almost all foods contain some protein, foods are classed as protein foods only when the amount of protein is sufficient to be of definite value when the food is ingested in normal amounts. The chief sources of protein are meat, fish, eggs, cheese, beans, peas, lentils, nuts, and cereals. The fuel value is approximately the same, 4 calories per gram, whether the protein is of high or low value biologically. As their structure indicates, they are sources of phosphorus and sulfur as well as of other minerals. No generalization can be made as to their vitamin content, except that they are sources of the vitamin B complex.

Protein consumed in excess of that used directly for structural purposes exerts a dynamic effect upon the metabolism. This results in increased metabolic rate (see Metabolism, Chapter II) or body heat. Such an effect may be desirable in winter, but certainly is not desirable in hot weather or under certain disease conditions.

Excess protein normally is not retained in the body. Excess fat, and carbohydrate which is converted into fat are stored.

In the **breakdown of protein in the body** certain amino acids are found to be capable of yielding glucose (a simple sugar) and

others of yielding a fatty acid. This fact is of importance in the diet planning for those conditions in which carbohydrate metabolism is impaired, since this glucose is treated by the body in the same manner as ingested glucose. On the average, 50 per cent of the protein by weight may be considered to be potential sugar and 50 per cent to be potential fatty acid (58 per cent glucose and 46 per cent fatty acid, to be exact; the total of 104 per cent is due to the overlapping of certain amino acids). If adequate protein is not present in the diet, one tissue may be called upon to supply repair material for a more important one. Such a shift takes place in starvation, wasting diseases, and sometimes when high fever is present.

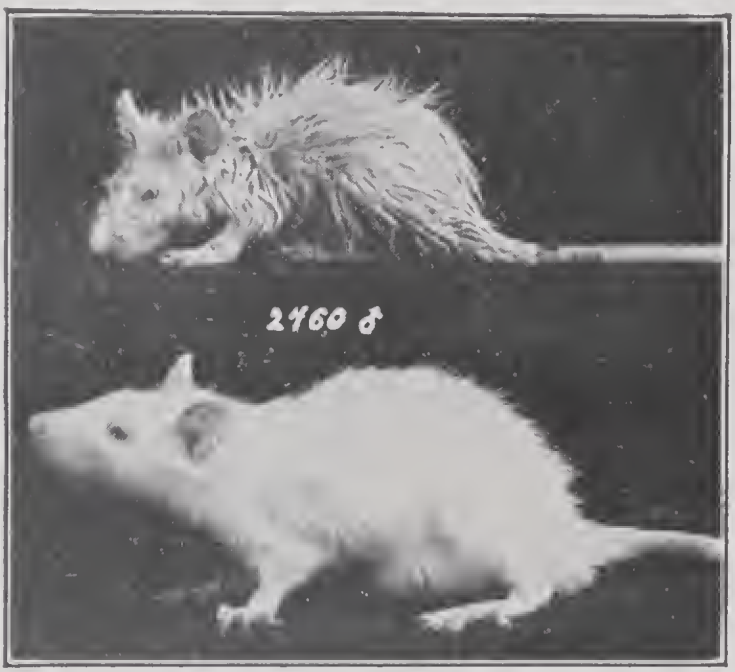


Fig. 7.—The upper photograph shows the effect of a dietary deficiency of the amino acid, valine. The lower photograph shows the same animal after valine had been administered for twenty-five days. (From Rose and Epstein: J. Biol. Chem. 127: 683, 1939.)

It is possible to decrease protein oxidation by inclusion of an abundance of carbohydrate; hence one speaks of **the sparing action of carbohydrate.** Protein is much more efficiently used in the presence of abundant carbohydrate than in the presence of abundant fat. Carbohydrate, therefore, is a more effective protein sparer than fat.

The protein metabolism of the body may be measured by the **nitrogen of the urine.** When the nitrogen eliminated is exactly equal to the nitrogen of the diet (protein is approximately 16 per

cent nitrogen), nitrogen equilibrium (or nitrogen balance) is said to exist. If outgo exceeds intake, a loss of body protein is indicated, and the balance is negative. Such a condition exists when the metabolism is elevated in fevers or toxic states. If intake exceeds outgo, there is storage of protein, and the balance is then positive. Recovery from a malnourished state, a healing process, pregnancy, or lactation results in storage. The normal maintenance diet should be such that nitrogen equilibrium is possible. The protein level at which nitrogen equilibrium can be established is dependent upon the carbohydrate level of the diet and the total caloric intake.

The **protein requirement** has been a controversial matter for some years. There have been those who advocated very low protein intake on the premise that large intake increases the work thrown on the kidneys (the excretion of urea and ammonia, as well as the acids resulting from the mineral content of the protein). There have also been those who advocated high intake of protein. Today the consensus is that a middle course is preferable. If protein supplies from 10 to 15 per cent of the total calories in the diet, the intake will be entirely satisfactory for optimum nutrition. Such percentage is obtained by supplying from 1 to 4 gm. of protein per kilogram of body weight. In the infant and young child the protein intake is relatively higher, since growth activity is at a maximum. During these early years 4 gm. per kilogram is usually ingested; later as the first rapid growth diminishes (at 5 to 7 years), the protein may be dropped to 2½ gm. per kilogram until after puberty. During adult life the protein can be decreased to 1 gm., and in old age to ⅔ gm. if desired. It should never be allowed to drop below this level. When it does, insufficient protein is supplied for the daily wear and tear of body tissues. If the intake is inadequate, body tissue will be burned and protein deficiencies will occur. Even when theoretically the lowest possible protein intake is desired, as in certain clinical conditions, an intake below this level will result in symptoms as harmful as those the diet is designed to alleviate. When this low level is used, it is important that the protein ingested be of high biological value (animal protein).

The body proteins are continuously undergoing synthesis and breakdown. They are not static tissues; resynthesis occurs even

in the starved animal. This new idea is contrary to the older theory which postulates little or no change in the tissues once they are formed. The breakdown and rebuilding are normally in such balance that total body protein remains essentially unchanged. Experiments on rats indicate that half of the body proteins will undergo such change in a week's time.

With the higher levels of 1 gm. or more per kilogram, proteins of lower biological value may supplement the animal group. The general dietetic practice of obtaining half of the protein from animal and half from vegetable sources results in a satisfactory balance of amino acids and is both economical and palatable.

Obviously during recovery from wasting diseases, and during pregnancy and lactation, higher protein levels are required.

Since protein is approximately 16 per cent nitrogen, the amount of protein metabolized can be calculated by multiplying the nitrogen in the urine by the factor 6.25 (100 ÷ 16 per cent). In fact, the protein content of food is determined by multiplying the nitrogen value, as ascertained chemically, by this factor.

Protein Foods

As has been pointed out, an adequate amount of protein is essential for normal growth and development, and approximately one-half of the protein must be of high biological value. Knowledge of the protein foods available is essential if one is to meet this requirement intelligently.

Milk, the first protein food which comes to mind, is of great importance throughout life. Its routine inclusion in the daily diet from the *minimum* of one cup, or preferably one pint, for the adult, to one quart for the growing child per day, is protection against deficiencies of protein, calcium, phosphorus, and vitamins A and B_2 (or riboflavin).

The **composition of milk** varies slightly with the breed of cow, season of the year, and feeding schedule, but the average composition is 87% water, 3.3% protein, 4% fat, 5% carbohydrate, and 0.7% minerals. Its **caloric value** is approximately 680 calories a quart. The specific nutritive value of a quart is indicated in Table 14.

Since milk forms such an important item in the diet of the child and the invalid, it is marketed under strict sanitary control

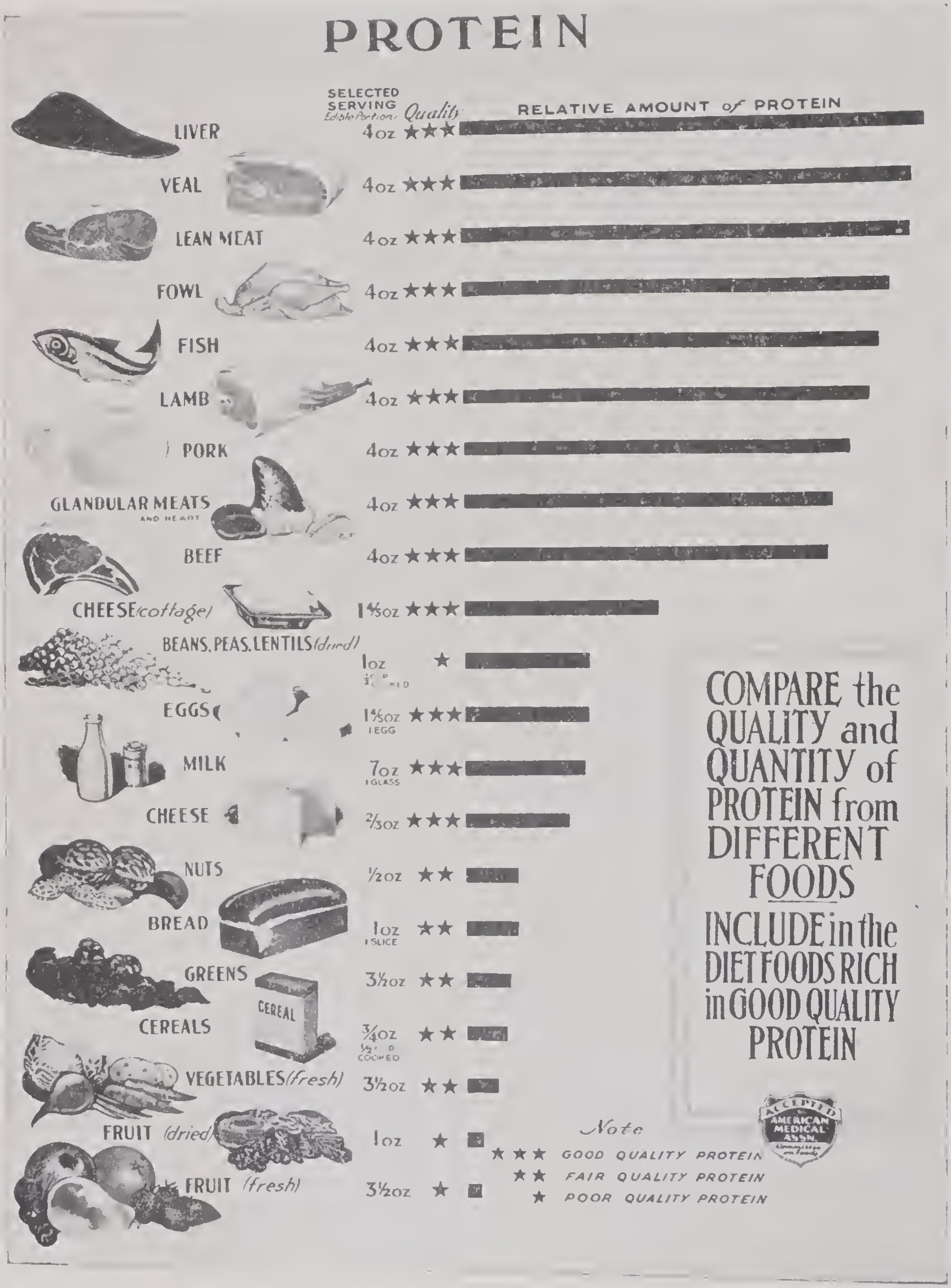


Fig. 8.—Protein content of foods. Chart prepared by The National Live Stock and Meat Board of Chicago, Ill., and reproduced through the courtesy of Anna Boller Beach.

TABLE 14

NUTRITIVE VALUE OF 1 QUART OF MILK

(Approximately 680 calories)

Protein 32 gm.
Fat 40 gm.
Carbohydrate 48 gm.
Calcium 1.2 gm.
Phosphorus 0.9 gm.
Magnesium 0.12 gm.
Potassium 1.4 gm.
Sodium 0.5 gm.
Chlorine 1.1 gm.
Sulfur 0.3 gm.
Iron 0.002 gm.
Copper, Manganese, and Iron
Vitamin A 2,400 I.U.
Vitamin B_1 200 I.U.
Vitamin C 10 mg.
Vitamin B_2 480 Sherman-Bourquin units
Vitamin D 20 I.U. (except irradiated milk, 135 units, or fortified milk, 400 units)

and inspection, and is graded according to bacteriologic standards into certified, grade A, and grade B. Certified milk may be sold in the raw state; other grades of milk must be pasteurized.

By pasteurization is meant the heating of milk to destroy bacteria which might either cause gastrointestinal upsets or spread disease. In the usual method ("hold"), milk is raised to a temperature of 60 to 63° C. (140 to 143° F.) and held there for twenty to thirty minutes.

Excess fluid milk, or milk produced in sections well adapted to dairying, but far removed from immediate consumers, is preserved for future use by evaporation into three different products. *Evaporated* milk is milk concentrated to approximately one-half its original volume. No sugar is added, but it is subjected to much drastic heat treatment (more so than condensed milk). Evaporated milk is heated to 226° to 240° F. for thirty to sixty minutes to assure preservation.

Condensed milk has sugar added to it in the amount of 60 pounds to 100 pounds of milk before the process of evaporation is begun. It is preheated to 160° to 180° F. and is then evaporated in vacuo (in vacuum) at 130° to 150° F. until one pound is equivalent to approximately 2¼ to 2½ pounds of the original milk.

Several processes have been invented for the reduction of milk to *powdered* form. Thin layers are passed over heated rollers in

vacuo, air is blown through perforated drying cylinders through partially evaporated milk, or the partially evaporated milk is sprayed into warm drying chambers.

As a result of these processes the composition of milk becomes:

	% P	% F	% C	% Ash	% H_2O
Evaporated	9.6	9.3	11.2	1.7	68.2
Condensed (sweetened)	8.8	8.3	54.1	1.9	26.9
Powdered or dried	26.7	28.0	38.0	5.8	1.5

Homogenized milk is milk which has been forced under high pressure through fine apertures, with a resulting decrease in the

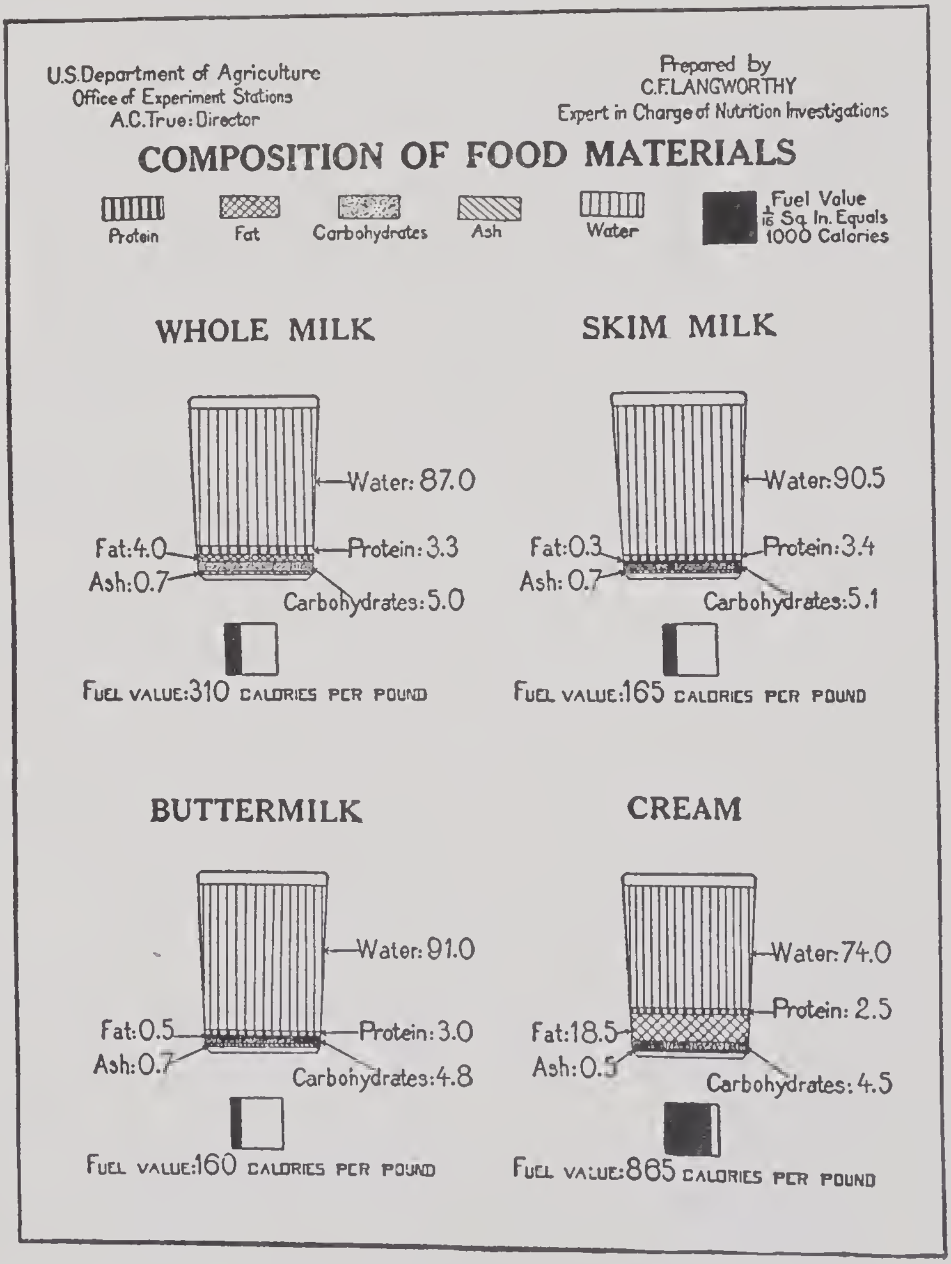


Fig. 9.—Composition of Milk.

size of the fat globules. This marked decrease in the fat droplet size alters the quality of the milk. No longer will the cream rise to the surface when the milk is allowed to stand; the mixture is homogeneous throughout. The curd size is smaller and somewhat more easily digested. There is a slight alteration in flavor.

The proteins of milk are three: casein (2.7 per cent), lactalbumin, and lactoglobulin (the latter two together form 0.5 per cent; see Proteins, classification). The carbohydrate is in the form of lactose (milk sugar). The fat is a mixture of the glycerides of palmitic, oleic, myristic, and butyric acids. The first two glycerides occur in greatest amounts. The fat is emulsified in the form of very fine droplets, which increase the ease of its digestion. The important minerals of milk are calcium 0.120 gm., phosphorus 0.093 gm., and potassium 0.143 gm. per cent. The major deficiency of milk is its low iron content. The iron present is, however, in readily available form. The lack of iron is compensated for in early life by the extra iron stores in the liver of the newborn.

As the result of pasteurization the vitamin C (ascorbic acid) content of milk is lowered to around 1 mg. per 100 gm. or roughly to one-half that of the raw milk.

Milk is an economical food at any unit cost that may prevail. No other single food contributes so much in nutriment. Table 11 indicates its nutritive value.

In the book *Your Meals and Your Money,* Gove Hambidge writes: "Perhaps no single thing would bring about a greater improvement in the American dietary as a whole, than a liberal use of milk and milk products."

Where whole milk seems costly. skim milk and evaporated milk make satisfactory substitutes. When skim milk is used, the decrease in calories due to fat subtraction, and the loss of the fat-soluble vitamin A must be considered.

The importance of protein and minerals in growth is indicated by the data which are presented in Table 15. The milk secreted by those animals whose young mature rapidly has a higher protein and mineral content which makes the growth rate possible.

Various commercial milk products are available, protein milk, lactic acid milk, hypo-allergic milks, and others. These have their places in therapeutic diets, but space does not permit a discussion of them here.

TABLE 15

PROTEIN IN RELATION TO GROWTH RATE

ANIMAL	DAYS REQUIRED TO DOUBLE BIRTH WEIGHT	PROTEIN	LIME	PHOSPHORIC ACID
Man	180	1.6	0.328	0.473
Horse	60	2.0	1.240	1.310
Cow	47	3.5	1.600	1.970
Goat	19	4.3	2.100	3.220
Pig	18	5.9	–	–
Sheep	10	6.5	2.720	4.120
Dog	8	7.1	4.530	4.930
Cat	7	9.5	–	–

In the souring process of milk, lactic acid is formed by the action of bacteria upon lactose content.

Under the heading of milk products are included skim (or skimmed) milk, buttermilk, butter, cream, and cheese. Skim milk is whole milk from which essentially all the cream or butter fat has been removed. Buttermilk is the skim milk left after the butter has been churned or made to collect as a result of agitation. Buttermilk is also prepared synthetically by the addition of a bacteriologic agent to either skim or whole milk. Churned buttermilk is usually so designated.

Cheese is the clotted portion of milk and has, therefore, a high protein content. Left behind after the removal of the curd, is a milky liquid known as whey. This has the composition: water 83%, protein 1%, fat 0.3%, carbohydrate 0.5%, and minerals 0.7%. It contains lactalbumin, soluble salts, water-soluble vitamins, and sugar. Cheese is of two main classes, hard and soft. The manufacture of cheese was probably originally a means of preservation of milk, but today cheese forms an important part of the diet. It ranks first from the standpoint of amount of protein. No other food contains more per unit of weight. For example, an American cheese (hard) gave an analysis of water 27%, protein 28%, carbohydrate 4%, and minerals 4%. Meats and fish vary from 13 to 25% protein, beans 22%, cereals 8 to 12%, and fruits and vegetables 1 to 3%. One pound of cheese is equivalent to 1 gallon of milk in protein value.

Cheese is marketed as skim milk cheese, cream cheese, or full cream cheese, depending upon the fat content. Cheese may be somewhat difficult to digest because of its high fat content and its

texture. The soft but solid firmness of the harder cheese, makes permeation by digestive juices difficult when particles are large. Inability or failure to masticate cheese thoroughly is however, the probable cause of this difficulty, since most cream or soft cheese

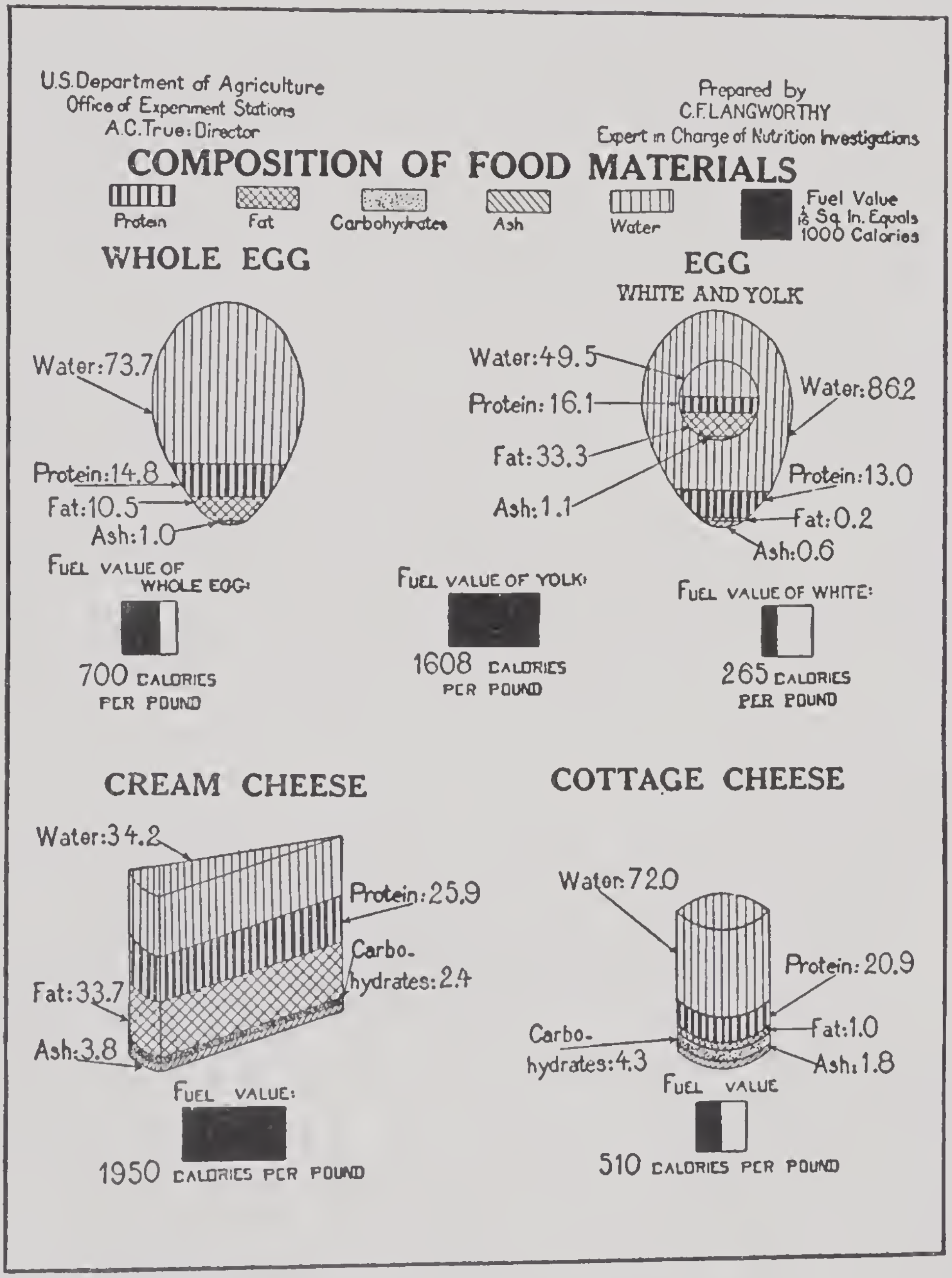


Fig. 10.—Composition of eggs and cheese.

is well tolerated. Another factor may be that cheese frequently is eaten at the end of a hearty meal with crackers or pie, when food intake is already adequate.

Eggs. Milk and eggs are sometimes spoken of as perfect foods because they alone adequately support growth or development of

the young. Egg contains approximately 74% water, 14.5% protein, 10.5% fat, and 1% minerals. The white contains albumin, globulin, glycoproteins, and ovalbumin. The yolk contains albumin, nucleo-albumin as vitellin and lecithin, phosphorus, calcium, sulfur, potassium, and iron. The fat is admixed with the protein in the egg yolk to form an emulsion (see Chapter V). Egg yolk is also a carrier of vitamins A, B_1, B_2, and D. Eggs are digested readily and completely, and may be incorporated in the diet of even the small infant and the acutely ill. Their daily inclusion in the diet is wise. Certainly the weekly intake should not fall below four eggs.

Meat

All meat has essentially the same physical structure, nutritive value, and digestibility. As the term is usually used, it includes poultry and fish.

Meat or muscle tissue is composed of bundles of tiny fibers embedded in and held together by white fibrous connective tissue. The length of these bundles and the extent of the connective tissue largely determine the tenderness of the meat. In the young animal with unused muscles the fibers and connective tissue are tender; but as he grows older and exercises more, they become increasingly tougher. Imbedded with the fibers in the connective tissue is a fat characteristic of the animal. This varies in amount but even the leanest meat has some fat.

Meat is 13 to 25 per cent protein, uncooked weight (25 to 30 after cooking), 10 to 15 per cent fat, 50 to 60 per cent water, and 1 per cent ash. Meat is an excellent source of the B vitamins, including niacin, which is present only in traces in dairy products and eggs, and of phosphorus, potassium, and sulfur. Its caloric value varies with the fat content from 25 to 100 calories per ounce, averaging 60 calories.

The question often arises as to the differences in **digestibility of different meats.** So far as experimental work can demonstrate, there is no appreciable difference in the digestibility of the different kinds of meat if they are properly cooked. The fat of meat, if eaten in large amounts, would slow up digestion by holding the food longer in the stomach; but one is not likely to eat enough fat to make this factor one of importance. Meats owe

their flavor largely to the extractives which are present. These extractives have a stimulating effect on the flow of gastric juice. Meats are almost completely digested with ease (96 to 98 per cent). Contrary to the often expressed theory, this does not mean that meat is a constipating food, even though it leaves little residue.

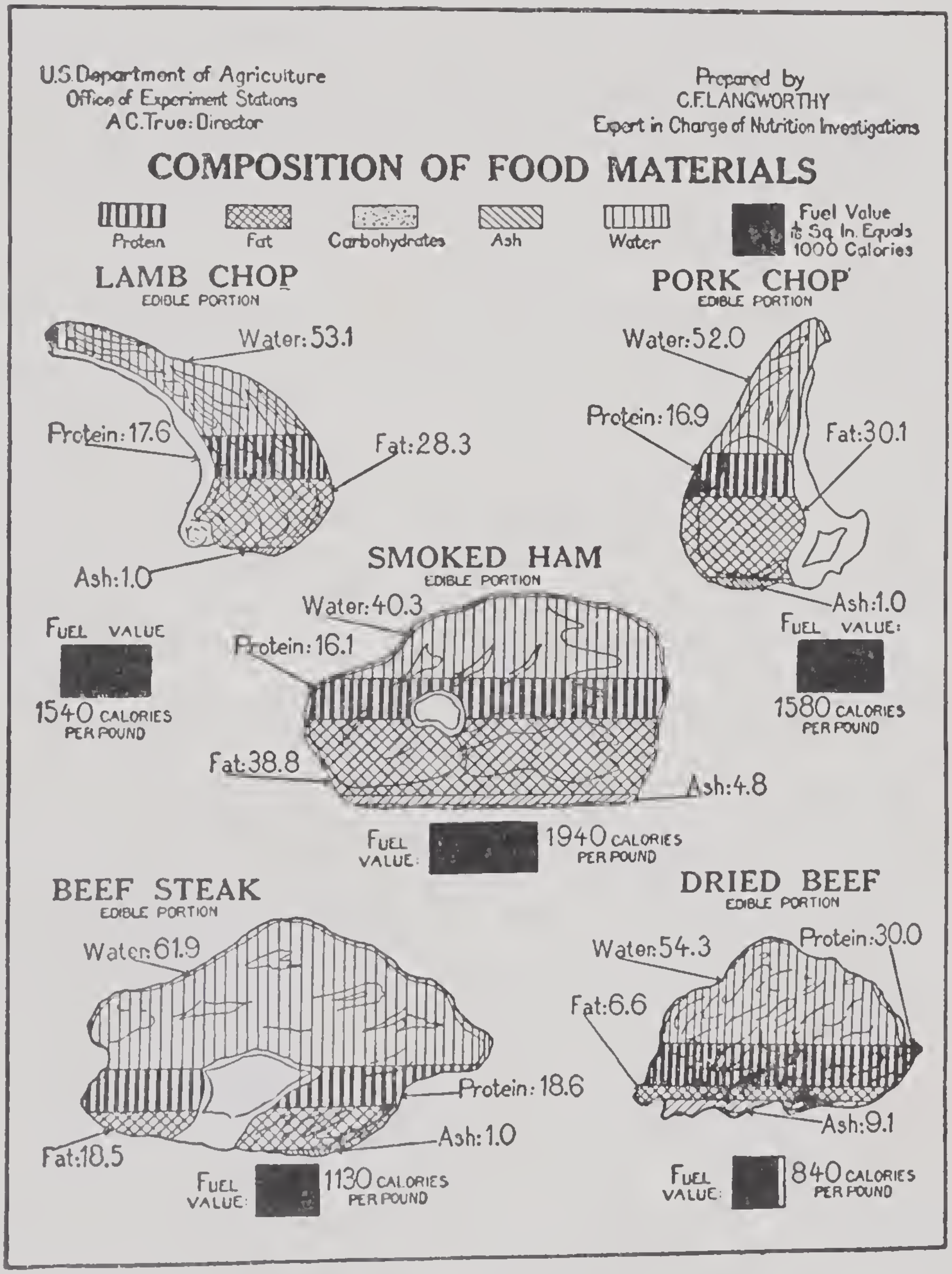


Fig 11.—Composition of meat.

The fact that we do not consume meat alone at a meal, but accompany it with vegetables or foods having bulk or residue, counteracts this effect. No food has the unique ability "to constipate."

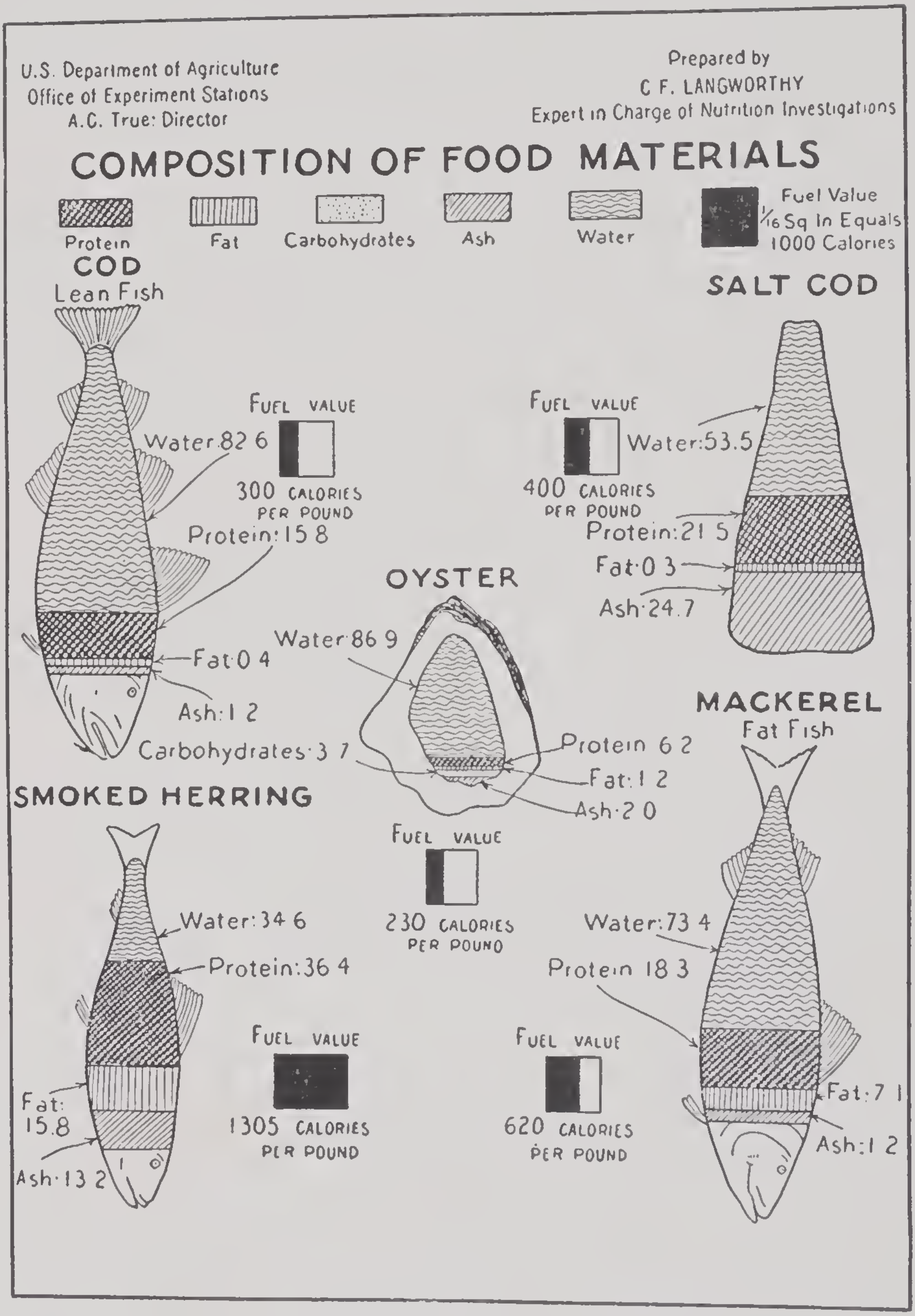


Fig. 12.—Composition of fish.

The ease with which meat is digested is indicated by the fact that small infants, even premature, do remarkably well on it.

The idea that a difference exists between light and dark meats, or light meats and red meats, is also prevalent. Dark meats do have slightly longer fibers and red meats a higher extractive content, but, in general, *the digestibility and composition are sufficiently equal to make discrimination unnecessary.*

The **edible glandular meats** fortunately are now coming into common usage. Our early ancestors considered the entrails of animals a luxury. Uncivilized tribes still do. As a result, they have at hand means of preventing dietary errors. The edible glandular meats, liver, kidney, and heart, are excellent foods as current research indicates.

TABLE 16

ESSENTIAL NUTRIENTS IN GLANDULAR MEATS*

	LIVER	KIDNEYS	SWEET-BREADS	BRAINS	TONGUE	HEART
Protein	20 gm.	15 gm.	20 gm.†	10 gm.	19 gm.	17 gm.
Vitamin A	12,500 I.U.	1000 I.U.		14 mg.		
Vitamin D	45 I.U.					
Ascorbic Acid	35 mg.	14 mg.	45 mg.			
Thiamine	0.38 mg.	0.32 mg.	0.32 mg.	0.25 mg.	0.28 mg.	0.38 mg.
Riboflavin	2.90 mg.	2.00 mg.	0.52 mg.	0.26 mg.	0.22 mg.	0.90 mg.
Niacin	18.0 mg.	8.5 mg.	5.8 mg.	5.0 mg.	6.2 mg.	7.5 mg.

Courtesy of the American Meat Institute.

All values given are per 100 gm. of fresh substance.

*Vitamin values according to Waisman and Elvejhem "Vitamin Content of meat"; Burgess Publishing Company, Minneapolis, Minnesota, 1941.

†Cooked.

Liver comes nearer to being a "panacea" for all *ills* than any other food. It is a protein of the highest order, contains rich stores of vitamin A and all of the members of the B group of vitamins. In addition, it is the greatest of all stimulators in the formation of red blood cells. Liver is an excellent source of iron and copper, but the power that it exerts in blood formation is out of proportion to this mineral content. Liver should be served once a week, and more often if desired.

Vitamin retention in meat during cooking is summarized in *Food and Nutrition News** in the following statements:

*Volume 18, April, 1947. Published by the National Live Stock and Meat Board, Chicago, Illinois.

"In general it may be said that for all methods of meat cookery an average of 70 per cent of the thiamine and 95 per cent of the riboflavin and niacin are retained in the meat plus the drippings during cooking. As for the less well known members of the B complex, about 80 per cent of the biotin is retained in the meat plus the drippings; destruction or leaching of choline from meats during cooking is negligible; and retention of pyridoxine in meat and drippings surprisingly low in view of the fact that this vitamin is considered to be one of the heat stable members of the B complex. Retention in the meat and drippings is seldom more than 45 per cent.

"Folic acid is another B vitamin that is unstable to cooking. Results indicate that only a little over 25 per cent of the folic acid present in fresh meat is retained in cooked meat.

"Recent work by Dr. Cover at Texas A & M has shown that meat for stews may be seared or not and then cooked by simmering, boiling or in a pressure saucepan with a large or small amount of water without appreciably affecting its vitamin content, provided all of the broth is used.

In summary, it may be said that meat, even after it is cooked, is still an excellent source of the B vitamins because of its original high content."

Fish are commonly considered in two groups: those having a backbone (the vertebrates) and the shell fish. They may be further classified as fresh- and salt-water fish, lean or light fish, and oily or dark fish. Salt-water fish have the advantage of having a higher mineral content; this is of value as it pertains to fluorine and iodine. The dark or oily fish have a much higher fat content than the lean, a fact that may necessitate choice between them for dietary reasons.

While legumes (beans, peas, lentils, and peanuts) are classified as vegetables, they supply protein which has considerable value when supplemented by a small amount of animal protein. Lima beans have a protein value of 8 per cent; soy beans, 13 per cent; and peanuts and peanut butter, 26 per cent.

Nuts are usually listed as fatty foods due to their high fat content, but their protein content is likewise high, from 15 to 30 per cent.

Cereals have a protein value of roughly 10 per cent.

These proteins certainly should not be neglected when the high cost makes meat difficult to obtain in adequate amounts.

One of the objections to the use of dairy products and eggs as the exclusive source of animal protein is their low content of niacin, one of the B vitamins necessary for the prevention of pellagra. See chapter on Vitamins. As has been pointed out, reliance on an egg and a pint of milk as the source of animal

protein will yield only about 1 mg. of niacin, whereas a serving of steak would yield 6 mg., a serving of liver 16 mg., and a tablespoon of peanut butter 16 mg., essentially the day's requirement. All of this emphasizes the need for variety in the diet if adequacy is to be obtained.

Review Questions

Why is it essential to include proteins in the diet of human beings?

What are the structural units of proteins?

Distinguish between complete, or class A, proteins and incomplete, or class B, proteins.

What are the principal food sources of the complete proteins?

What function may the incomplete proteins fill in the dietary? Name sources of these.

How does the chemical structure of protein differ from carbohydrate and fat?

What purpose besides cell building may proteins serve? Is it economical to include them in the dietary for this purpose?

What two products do proteins yield when broken down in the body? Approximately in what proportions?

How may the protein metabolism of the body be measured?

What is meant by nitrogen equilibrium?

What is considered a satisfactory amount of protein to include in the daily dietary of adults for optimum nutrition?

What is the minimum amount below which it should not go?

Why is milk considered such an important protein food?

Distinguish between the various marketing grades of milk.

What is pasteurization?

In what other forms is milk sold?

Name the principal milk products.

Why are eggs as well as milk sometimes spoken of as perfect foods?

What food nutrients beside protein does meat contain?

Are meats easily digested?

Is it necessary to distinguish between light and dark or red meats from the point of view of digestibility?

What place should the glandular meats hold in the dietary?

Are fish and poultry considered meat in the human dietary?

CHAPTER V

THE FATS

Fat, with its caloric value approximately twice that of carbohydrate and protein, is an important source of energy. It is stored in considerable amount in animal tissue, where it serves as the reserve fuel supply in a fashion similar to carbohydrate storage by the plant. To a lesser extent fat occurs in plants where it is usually stored in the germ portion. Fat also acts as padding and support for the organs, and as an insulator against rapid body temperature change.

The fats, also known as lipids, are simple esters of glycerol and fatty acid, and are named according ~~to~~ this fatty acid molecule, as stearin from stearic acid, and olein from oleic acid. The hardness of any fat is determined by the fatty acid in combination with the glycerol. The fats range in firmness from the oils to fats of extreme hardness. The term lipid is an inclusive one and includes not only true fats but other substances having the physical properties of fats.

Bloor classifies the lipids as:

1. **Simple lipids:** Esters of fatty acids and alcohols.
   a. Fats, esters of fatty acid with glycerol. The familiar animal and vegetable fats belong to this group.
   b. Waxes, esters of fatty acids with an alcohol other than glycerol; for example, beeswax, wool wax, spermaceti, etc.

2. **Compound lipids:** Esters of fatty acids containing groups in addition to the fatty acid and alcohol radicals.
   a. Phospholipids, containing in addition, phosphoric acid and nitrogen. Lecithin, a necessary constituent for cell life, belongs to this class. It is found in egg yolk, milk, brain, bile, nerve tissue, and other animal tissues.
   b. Sterols, large molecular alcohols combined with fatty acids, as for example, cholesterol and ergosterol. Cholesterol, one of the animal sterols, is widely distributed in nature. It is a constituent of bile, being held there in solution by the bile salts. Its presence in cells gives to them the property of holding water. Ergosterol is a characteristic sterol of plant life. When irradiated, it is known as calciferol which, when dissolved in oil, is commercially known as Viosterol or vitamin D_2.

   Animal sterols can also be irradiated and when dissolved in oil are known commercially as Delesterol or vitamin D_3.

The compound lipids are known as lipoids. They are fat-like substances but are more complex than the true fats—hence, are more reactive. Active body tissue contains fat in this form.

Other groups are of lesser importance and need not be discussed here.

Certain fats and oils are unsaturated, that is, they have double bonds capable of opening and receiving other radicals. Such fats are soft in texture but may be hardened by the addition of hydrogen (through hydrogenation) to solid substances. Fats so saturated do not become rancid as do fats in the unsaturated state, a point of practical importance. The rancidity of fats is due to a partial oxidation of the unsaturated groups, hydrolytic changes and bacterial action. Such changes decrease both the palatability and vitamin value. The degree and speed of rancidity vary with individual fats. Advantage is taken of this in the hydrogenation of cottonseed oil to form many popular shortenings.

Recent experimental studies indicate that some unsaturated fatty acids are indispensable to good nutrition. They are "**essential fatty acids**" and are either not synthesized or not synthesized rapidly enough in the animal body to permit their omission from the diet. These essential fatty acids are linolenic, linoleic, and arachidonic. They are present in such food fats as soybean, whole wheat, unhydrogenated cottonseed oil (Wesson), corn oil (Mazola), peanut, linseed, and olive oils, and in egg yolk and to a lesser extent in lard.

Fats other than these essential fatty acids can be synthesized in the body from protein and carbohydrate. Excess food, not immediately burned by the body, is stored as body fat and is reflected in weight increase. This is an important factor in balancing the calorie budget or in effecting weight change.

The chemical structure of fat, carbon-hydrogen-oxygen, indicates that it can be completely oxidized to carbon dioxide and water either in the body or in the bomb calorimeter. In addition to its value in heat, 9.3, or roughly 9 calories per gram, fat is important as a carrier of the fat-soluble vitamins A, D, E, and K. Animal fats are important sources of vitamins A and D; vegetable fats, as sources of vitamins E and K (see Chapter X).

The fats are changed into their component parts, **fatty acids and glycerol** (glycerin), through the action of gastric and pancreatic juices (see Chapter VII). The fatty acids pass through

the intestinal wall as such, and then recombine to form neutral fat. This splitting by hydrolysis is called saponification. If alkali is present at this time, it reacts with the free fatty acid to form salts or soaps.

Fat absorption differs from the absorption of carbohydrate and protein in that the digestive end products of protein and carbohydrates enter the blood stream directly, while a portion of the end products of fat enter by way of the thoracic duct, having been absorbed first into the lacteals of the intestinal villi, passed through the lymphatics, and then on to the thoracic duct and the blood.

Bile is essential to fat absorption. Under the influence of bile salts, normally water insoluble fats or their component fatty acids, become water soluble, thereby making their passage through the intestinal epithelium possible. If bile is lacking or insufficient, and the fatty acids are not rendered water soluble, fat metabolism no longer proceeds normally and there is loss to the body of fat and fat-soluble vitamins. Also, in leaving the body by way of the feces, fat carries calcium with it in the form of calcium soaps. The amount of fat in the stools is made use of in laboratory studies of fat utilization.

While not so effective as carbohydrate in this role, fat has a protein-sparing action.

The **utilization of fat** by the body has long been considered to be dependent upon the presence of carbohydrate. There has long existed an adage that "Fat burns in the fire of carbohydrate." It postulated that unless carbohydrate was present fat would be incompletely oxidized to carbon dioxide and water. A residue would be left—ketone or acetone bodies (beta hydroxybutyric and diacetic acids and acetone)—which would circulate in the blood stream and produce a ketosis, a condition sometimes and less correctly called acidosis.

While this old adage is now known to be incorrect, the fact remains that, when an animal fails to use carbohydrate or has none to use, ketosis results. Ketosis results from starvation, in uncontrolled diabetes, and on diets which are high in fat and low in carbohydrate. Above a level of 60 per cent of the total calories in the form of fat, ketosis usually results. Sixty per cent is considered the *borderline* level for normal utilization.

The **fuel value** of all **fats** is approximately the same, even though the **food value** may be different. Animal fats, butter,

cream, egg yolk, and fish oils, are sources of vitamin A and in some instances of vitamin D. Fats of cereal and seed origin, cottonseed oil (Wesson), corn or maize oil (Mazola), are sources of the unsaturated or essential fatty acids and vitamin E (see Chapter X).

Most **margarines,** oleo and nut, sold today are fortified with additional vitamin A to bring their content of this vitamin up to 15,000 I.U. per pound—a value not far from the year-round average for butter.

One brand of margarine lists its composition as follows:

INGREDIENT	PERCENTAGE	WHY USED
American cottonseed oil	80.0%	An excellent energy food.
Cultured skim milk	16.5%	The fresh pasteurized and cultured skim milk which helps give it a delicate, appetizing flavor.
Salt	2.8%	To impart the proper seasoning.
Derivative of glycerine	0.5%	This product helps make it practically non-spattering when used in pan-frying.
Vegetable lecithin	0.1%	Reduces "sticking to the pan" in pan-frying.
Benzoate of soda	0.1%	A preservative. Helps retain its fine fresh flavor.
Vitamin A—15,000 units U.S.P. per pound		To make it a reliable year round source of this important vitamin.
Diacetyl		An artificial flavor. Enhances the flavor and aroma.

No clear-cut experimental evidence indicates the superiority of butter. Certainly in the light of the cost difference margarine is an excellent alternative.

In general, with the exception of egg yolk, fats have a low mineral content. Egg yolk is a good source of iron and phosphorus.

Fats in an emulsified form, like egg yolk, cream, and milk, are more easily digested than foods with the fat occurring in larger particles. An emulsion is a suspension of one finely-divided liquid in another one. How permanent this suspension will be depends upon how finely the first liquid is broken up, and secondly, upon the presence of a third substance which will prevent the fat globules from running together. Soap, gum arabic, or protein itself (as found in milk and egg yolk) serves this purpose. Fats with low melting points are more readily digested than those with high melting points.

The fat content of a meal influences its time in the stomach, and for this reason fat may be used to control hunger pangs. A meal moderately high in fat has greater satiety value; it is more satisfying because it "stays by" longer than a meal low in, or devoid of, fat. This is a point to be remembered in planning certain diets.

Much has been written regarding the **digestibility** of fatty, fried, and rich foods, which contain large quantities of butter or cream. The inclusion of excessive fat in any meal will retard its digestion, and may do so to the point that digestive processes cannot function normally. Further, fat may coat the protein and carbohydrate particles and prevent normal gastric digestion. This problem arises when foods are improperly fried, or when such foods as soggy pie crust are eaten. If foods are properly cooked in deep fat, a thin seared surface immediately appears which prevents further permeation of fat. Such a food has not been rendered indigestible. However, long soaking in fat the temperature of which is too low for immediate cooking does permit fat to permeate the food, thus decreasing digestibility. Proper cooking temperatures are important. The improper heating of fats may result in irritating breakdown products which are undesirable for a sensitive gastrointestinal tract.

The point at which decomposition takes place is variable. For example, the cottonseed and corn oils break down at 222° to 232° C.; the hydrogenated fats at essentially the same level, 219° to 232°. Lard undergoes change at a lower level, 214° to 221°, and, if the lard has been reused a number of times, at even a lower temperature of 190°. The value for butter is given as 208°, for olive oil 167° to 175°, and for peanut oil 150° to 160°. Cooking charts which are carefully worked out as to temperature should be followed if maximum digestibility is to be attained. Therefore, unless one can be assured that care is used in the frying process, it may be wiser to eliminate fried foods from a diet planned to remove strain from the digestive tract. Certainly, excessive amounts of cream, butter, greasy gravies, or mayonnaise have no place in such a diet. However, the slight delay in the stomach of fried food should in no way disturb the active healthy person.

The characteristic **flavor** of food fats is due to foreign substances which are either absorbed from their natural environment or

to substances which are produced during processing. For example, the bacterial flora of cheese and butter are carefully controlled so that the desired flavor is produced.

Recent experiments indicate that the presence of lecithin stimulates the rate of absorption and the extent of digestibility of fats. It has been suggested that this is due to its emulsifying action. In which case it is logical to expect enhancement due to homogenization of milk.

As in the case of proteins, it has been found that fatty tissue is not static but constantly in a state of flux. By feeding fats which were "tagged" or made radioactive, it was possible to trace their course through the body. "Surprisingly enough, those fat stores and pads which at times seem impossible to eliminate actually are constantly on the move. But body balance is so exact that the total amount and structure of the fat mixture in fat depots, blood, and organs remain constant. These fascinating chemophysiological studies made possible by the use of isotopes (different forms of the same element with almost identical properties), a new tool given us by the atomic bomb studies, may well alter many of our current concepts.

The amount of fat included in the diet has been gradually increasing in the past few years, the reason being the emphasis upon protective foods—the leafy vegetables, in particular, which require salad dressing or butter, the increased use of milk, cheese, and eggs, and an appreciation of the importance of fat-soluble vitamins. Formerly, the caloric percentage assigned to fats was from 20 to 35 per cent of the total. Today that percentage is at the higher level.

Recently, new interest has been evinced in the fat level of the diet, and the suggestion has been made that it should be held within a reasonable range (20 to 40 per cent). High fat diets, especially where the intake of cholesterol is high, have been accused of being factors in arterial changes. Deposits may be left along the vessel walls which gradually tend to constrict the lumen with a resulting rigidity and increasing blood pressure. In the light of these studies it probably is wiser, unless a therapeutic need arises where the advantages of high fat are greater than possible disadvantages, to hold the fat intake within the normal range. *Clinically* one already sees reduction to the lower

value of around 20 to 25 per cent, with restriction especially of the animal fats, with this thought in mind.

If the amount falls below 25 per cent of the total calories, satiety may be absent (as is demonstrated in diets which require

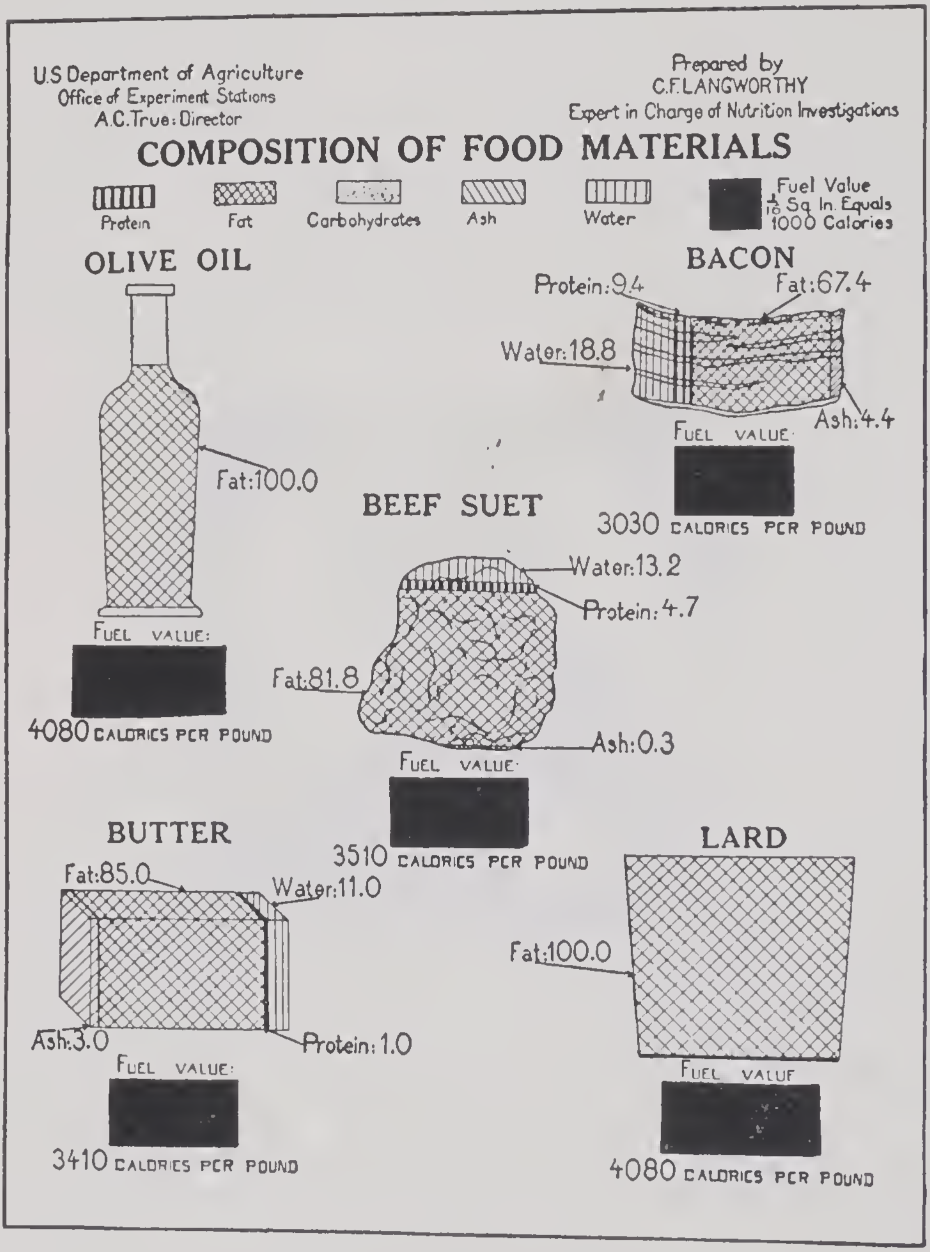


Fig. 13.—Composition of foods containing much fat.

a low fat intake). If the level is too high, a feeling of stuffiness and a dampening effect on appetite may result.

The level of 20 to 35 per cent of the caloric intake is supplied by a range of 1 to 3 gm. per kilo of body weight or a total of 75 to 150 gm. of fat.

The fat foods may be divided into two main groups, the **animal and vegetable fats,** as has already been pointed out. To the first group belong butter, cream, meat fats, oily or dark-colored fish, and egg yolk. To the latter group belong the seed and vegetable oils in their natural state, when hydrogenated into lard substitutes, or when churned with milk to make margarines for butter alternatives.

Butter is prepared by churning cream, a process which results in the coalescence of the fat globules. Butter is actually concentrated cream, and contains 85 per cent fat. It may be prepared from either sweet or sour cream, and is marketed in salted and unsalted forms. Salted butter made from sour cream is the more common form.

Fig. 14.—Beef fat. (From Hawk and Bergeim: *Practical Physiological Chemistry,* The Blakiston Co.)

Cream is the concentrated fat of milk. It is removed from the milk by various methods of separation, usually by centrifugal force. The degree of separation is expressed as percentage in commercially marketed cream—20, 30, and 40 per cent cream. The terms 2, 3, or 4×—light or coffee, medium, and whipping cream, are also used. By means of a separator it is possible to concentrate the fat to 60 per cent and by churning to 85 per cent (butter).

The **fat content of meats and fish** varies (see Chapter IV). Fat is stored in the cell walls of the connective tissues, around the internal organs, between the muscle fibers, and directly under the

skin. The degree of hardness, which is characteristic of each species, is dependent upon the fatty acid content. The percentage of fat varies from around 10 per cent in lean meat to 80 per cent in salt pork. The average fat content in medium lean meats is

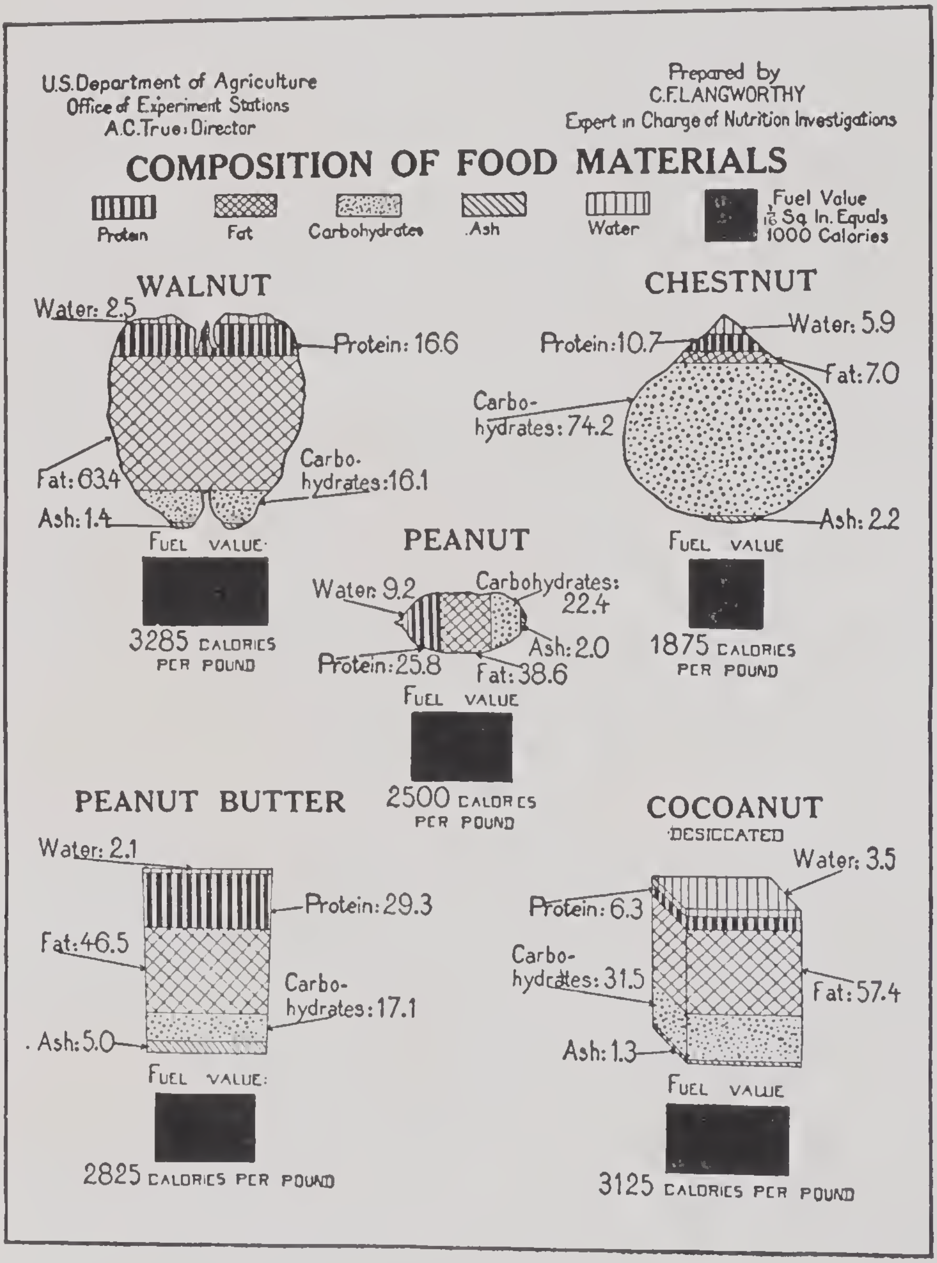


Fig. 15.—Composition of nuts.

15 to 25 per cent; in fish 2 per cent (cod) to 10 per cent (salmon), or 20 per cent (caviar). Meat from which all visible fat has been removed still contains 6 per cent fat.

Egg yolk contains approximately 10 per cent fat in the form of an emulsion. This fat is especially rich in phospholipid, choles-

terol, minerals and vitamins. The phospholipid lecithin gives rise to choline, one of the newly appreciated dietary essentials (see Chapter X). The phospholipids are integral parts of the protoplasm itself and, as such, are essential for life.

Cholesterol is the most important sterol which occurs in the animal kingdom; it occurs in all animal tissue in appreciable amounts. The cholesterol level of the blood has clinical significance. It is elevated in hypothyroidism and depressed with hyperactivity. It rises to a high level in nephrosis (see Chapter XXXVII), and it is occasionally deposited from the bile in the form of gallstones. Therefore, at times, dietary restriction is necessary. Table 109 indicates the cholesterol content of various tissues. Similar sterols occur in the vegetable kingdom, but these sterols are not absorbed through the human alimentary tract.

Lard, suet, and tallow are the fats of pork, beef, and mutton. Rendered free from connective tissues, they may be prepared as pure fat.

Cheese supplies appreciable amounts of fat, depending upon the type of basic milk. Cottage cheese, a skim milk product, contains only 1 per cent fat. Full cream cheese, cheddar, or Swiss cheese may contain as high as 35 per cent fat.

Nuts are rich sources of fat and protein and, except for chestnuts, are poor sources of carbohydrate. Nuts are good sources of copper, iron, and manganese, and contain B vitamins. Peanuts contain 50 per cent fat and 30 per cent protein; Brazil nuts, 65 per cent fat and 23 per cent protein; and pecans, 73 per cent fat and 9 per cent protein. The water content of nuts is low. They may be difficult to digest due to their physical texture and their high fat content.

Review Questions

What are fats chemically?

What other name is given to fats?

How are the fats classified?

What is meant by an unsaturated fat?

What are the "essential fatty acids"? Why are they so named?

What is the caloric value of fat per gram?

In addition to its energy value, why is fat an important constituent of the dietary?

Are the margarines satisfactory substitutes for butter?

What may be said in regard to the digestibility of the fats?

What percentage of the dietary should be provided by fat?

What are the important sources of fat in the dietary?

CHAPTER VI

THE CARBOHYDRATES

Carbohydrates are the third great class of foodstuffs. Chemically they are organic compounds composed of carbon, hydrogen, and oxygen. They are synthesized by plants under the influence of sunlight from the carbon dioxide of the air and water. In plant form carbohydrates are ingested by the animal and in the animal body are again completely broken down (oxidized) into carbon dioxide and water, $C_6H_{12}O_6 + 6O_2 = 6CO_2 + 6H_2O$. They are hydrates of carbon.

Carbohydrates supply the major part of our daily food. Cereal and cereal products, starchy vegetables, sugars, and fruits are all sources of carbohydrates.

Carbohydrates can be classified into three major groups, depending upon the complexity of the molecule: The monosaccharides or simple sugars, disaccharides which yield two simple sugars upon hydrolysis, and polysaccharides which yield more than two simple sugars upon hydrolysis or digestion.

Monosaccharides—($C_6H_{12}O_6$).

Glucose, known also as grape sugar, dextrose, and corn sugar, is found in abundance in fruits and plant juices. Grapes and sweet corn are especially rich sources of this sugar. As corn syrup it has become popular as the carbohydrate for modification of baby formulas, in candy making, jellies, etc. It results from the hydrolysis of other carbohydrates during the course of digestion and is the form in which sugar circulates in the blood.

Fructose is known also as fruit sugar and levulose. A mixture of glucose and fructose is known as invert sugar. Honey is such a mixture. Fructose is present with glucose in fruits and vegetables and serves, as does glucose, as a source of liver glycogen. These two sugars are interconvertible.

Galactose results, with glucose, from the hydrolysis of lactose or milk sugar. It too may be converted into glycogen. It does not occur free in nature. Compounds of galactose, or galactosides, occur in nervous tissue. Two molecules of galactose combine to form lactose.

The monosaccharides are crystalline, readily soluble, sweet, and are very easily digested.

Disaccharides—($C_{12}H_{22}O_{11}$).

Sucrose is ordinary table sugar. It is sometimes called cane sugar or saccharose. It is widely distributed in nature, usually mixed with glucose and fructose, in fruits and plant juices. Commercial sucrose is prepared from either sugar cane or sugar beet. On hydrolysis sucrose yields one molecule of glucose and one of fructose.

When part of the sucrose has been crystallized from cane sugar or beet syrup, molasses is left. Molasses contains much of the sucrose, the ash, and other constituents of the original syrup. It is of value as a source of iron and has recently been found to be a source of some of the B vitamins.

The chemical structure of maple sugar is identical with that of sucrose. This concentrated sap of the sugar maple tree gains its characteristic flavor from adhering substances.

Lactose yields equal parts of galactose and glucose upon hydrolysis. It is the form in which carbohydrate occurs in milk. Commercial lactose is prepared from whey, the by-product in the manufacture of cheese. Milk of all species of animals contains lactose in amounts from 4 to 8 per cent. Lactose is less sweet and less soluble than sucrose. Its chief use is in the diet of infants and invalids.

Maltose results from the action of a specific type of enzyme (amylase) upon starch. This action occurs during the germination or sprouting of cereals. Malt, usually derived from barley, is frequently used for its unique flavor as a sweetener of cereal products and in the preparation of malted drinks.

Disaccharides are crystalline, sweet, soluble, and easily digested. If abnormal conditions exist in the gastrointestinal tract, however, the ingestion of disaccharides may result in fermentation and gas formation and acute distress.

Polysaccharides—$(C_6H_{10}O_5)_n$, as the formula indicates, yield more than two molecules of simple sugar upon hydrolysis.

Starch is the form in which most plants store their food supply. In fruits this starch is converted into glucose as ripening proceeds, with resulting sweetness. Starch constitutes one-half to three-fourths of the solid matter of cereal grains. Through starch-splitting enzymes or acid hydrolysis, starch is converted through dextrins and maltose into glucose. Starch is not soluble in cold water, but in hot water it is absorbed and the starch grains swell and rupture.

Dextrins are intermediate breakdown products between starch and sugar. They are more soluble than starch and are slightly sweet to the taste. Toasting of bread dextrinizes some of the starch with a resulting flavor change. The caramelization of sugar produces a similar reaction.

Dextrin in solution is sticky, and this property is utilized commercially in the adhesive substance on postage stamps.

Glycogen is frequently called animal starch, since carbohydrate is stored in this form in the animal body. By digestion, vegetable starch is broken down into glucose and then rebuilt into animal starch or glycogen in the liver, where it is held for future use. As much as 200 to 300 gm. may be stored in the human liver. In addition glycogen is present in every body cell.

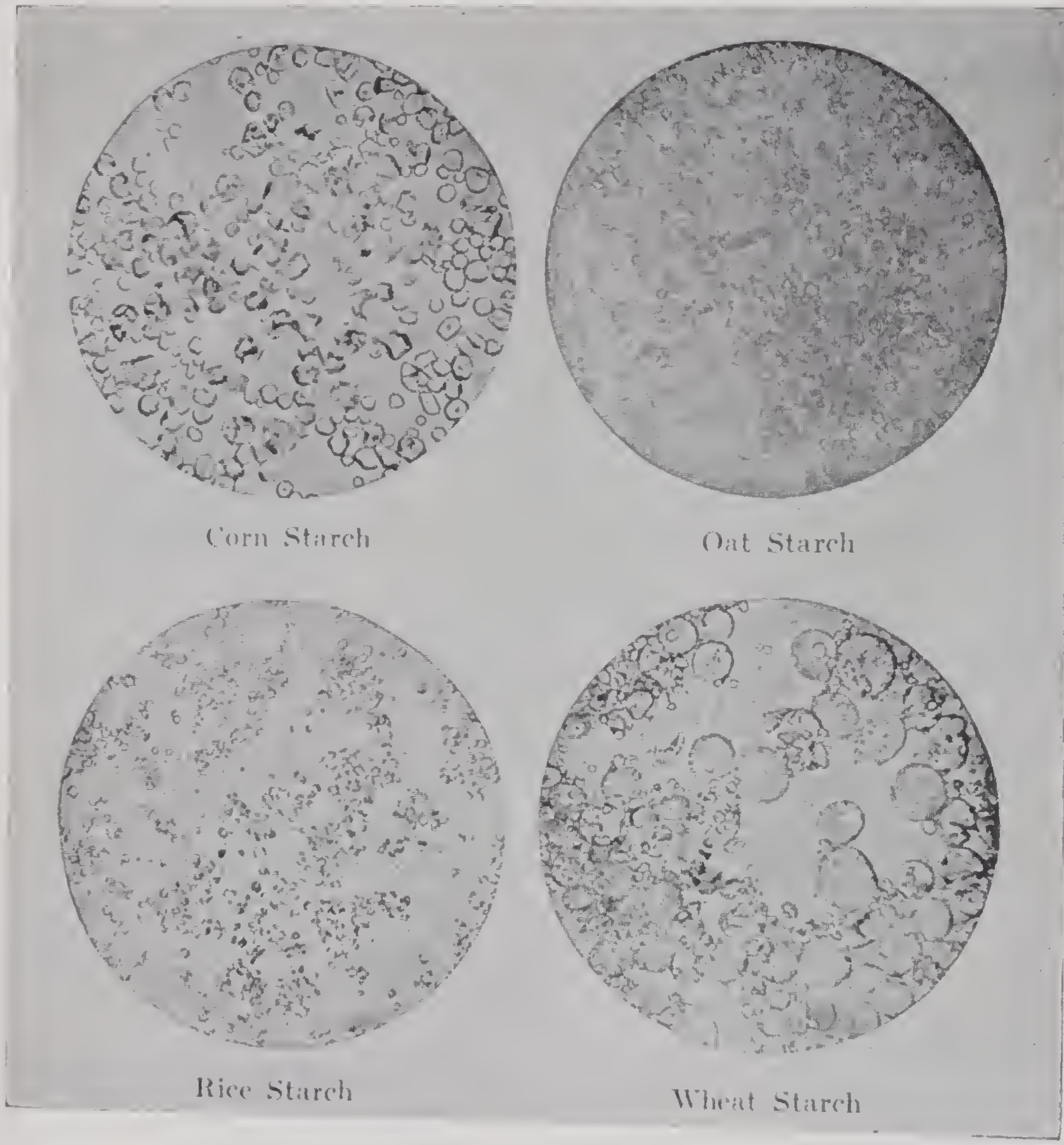


Fig. 16.—Starch grains magnified many times. (From Leach and Winton: *Food Inspection and Analysis,* John Wiley & Sons, Inc.)

Cellulose is the structural portion of plants. It forms the framework in which the starch granules are deposited. It is insoluble and is not digested by enzymes present in the human gastrointestinal tract, although herbivorous animals are able to utilize it. Cellulose is valuable as roughage, unless contraindicated in gastrointestinal abnormalities. When hydrolyzed with acid, cellulose yields glucose.

Cellulose is important commercially in the preparation of collodion, celluloid, cellophane, mercerized cotton, rayon, paper, and lacquers.

Inulin is the starch of dahlia tubers, of Jerusalem artichoke, mushrooms, and possibly to some extent is found in other vegetables. Inulin is not digestible, and for this reason is sometimes used in diet adjustment.

Agar-agar is the hemicellulose (cellulose-like material) of seaweed. It has no food value but is used medicinally.

Pectin is the hemicellulose which gives fruits the property of jelling. It occurs in varying amounts, but to the greatest extent in unripe fruit.

The polysaccharides vary in solubility and digestibility. They have little or no flavor, and are amorphous, not crystalline.

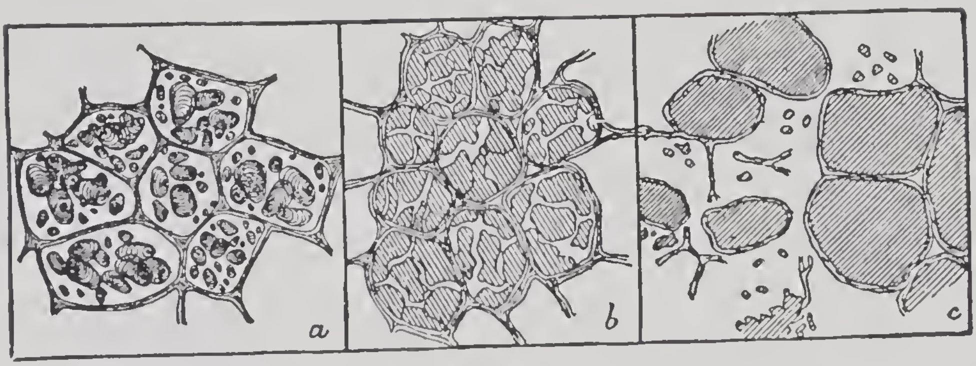


Fig. 17.—Changes of starch grains in cooking. *a*, Cells and starch grains in a raw potato; *b*, in a partially cooked potato; *c*, in a thoroughly boiled potato. (Courtesy of United States Department of Agriculture.)

The sugars eaten in concentrated form, as candy, jelly, frostings, syrups, or upon other foods, may be somewhat irritating due to their concentration. Sugars are preferably served in the form of fruit sugars admixed with other foodstuffs. The starches, on the other hand, if properly cooked so as to rupture the encasing membrane, are more slowly digested and absorbed, and are less irritating.

The carbohydrates are broken down through the action of specific enzymes (see Digestion, Chapter VII) to the simple sugars.

In years past, carbohydrates formed the bulk of the normal diet, supplying from 45 to 65 per cent of the total calories. Today, however, they are used less abundantly. Not more than 50 per cent of the calories are usually supplied by carbohydrate. The range is rather 40 to 50 per cent except in low cost diets where of necessity, cereals must be used in large amounts. They are bland in flavor, least costly of the foodstuffs, and occur in

such variety that they are well adapted to liberal use. Deviation from the range of 40 to 50 per cent of the calories (4 to 5 gm. per kilogram of body weight, or a total daily intake of 200 to 400 gm.) is at times necessary in diabetes, hypoglycemia, liver disorders, and epilepsy.

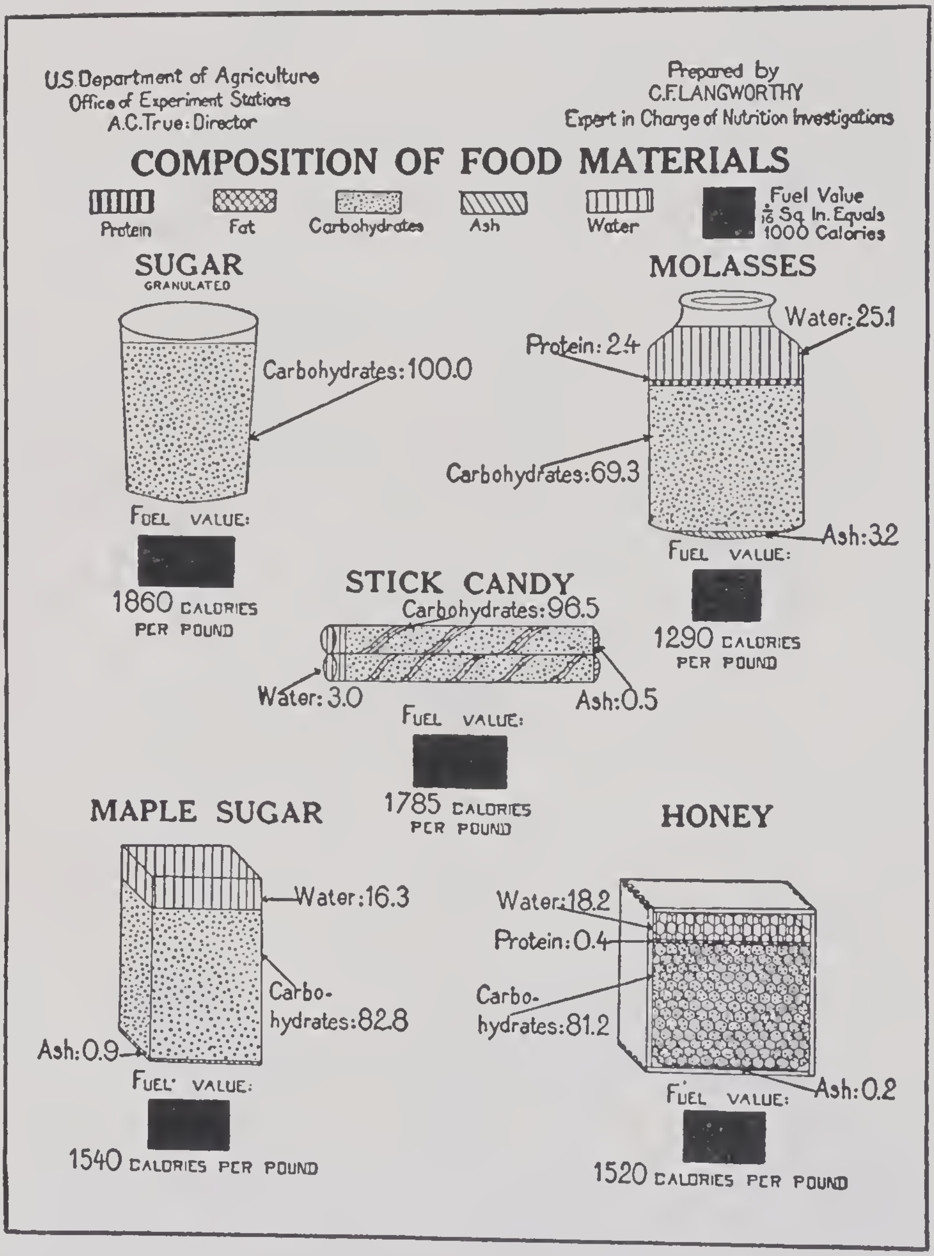


Fig. 18.—Composition of foods containing sugar.

The **cereals** and cereal products form the largest fraction of the normal diet. The choice of cereal may be influenced by racial habits and agricultural possibilities. Wheat, oats, and corn are the most widely used by the American people. Wheat is approximately

11% water, 12% protein, 2% fat, 71% carbohydrate, 2 to 3% cellulose, and 2% mineral matter. The character of the protein differs in the cereals; the principal protein of wheat is gluten, a combination of gliadin and glutenin. Gluten gives wheat flour its peculiar elastic property.

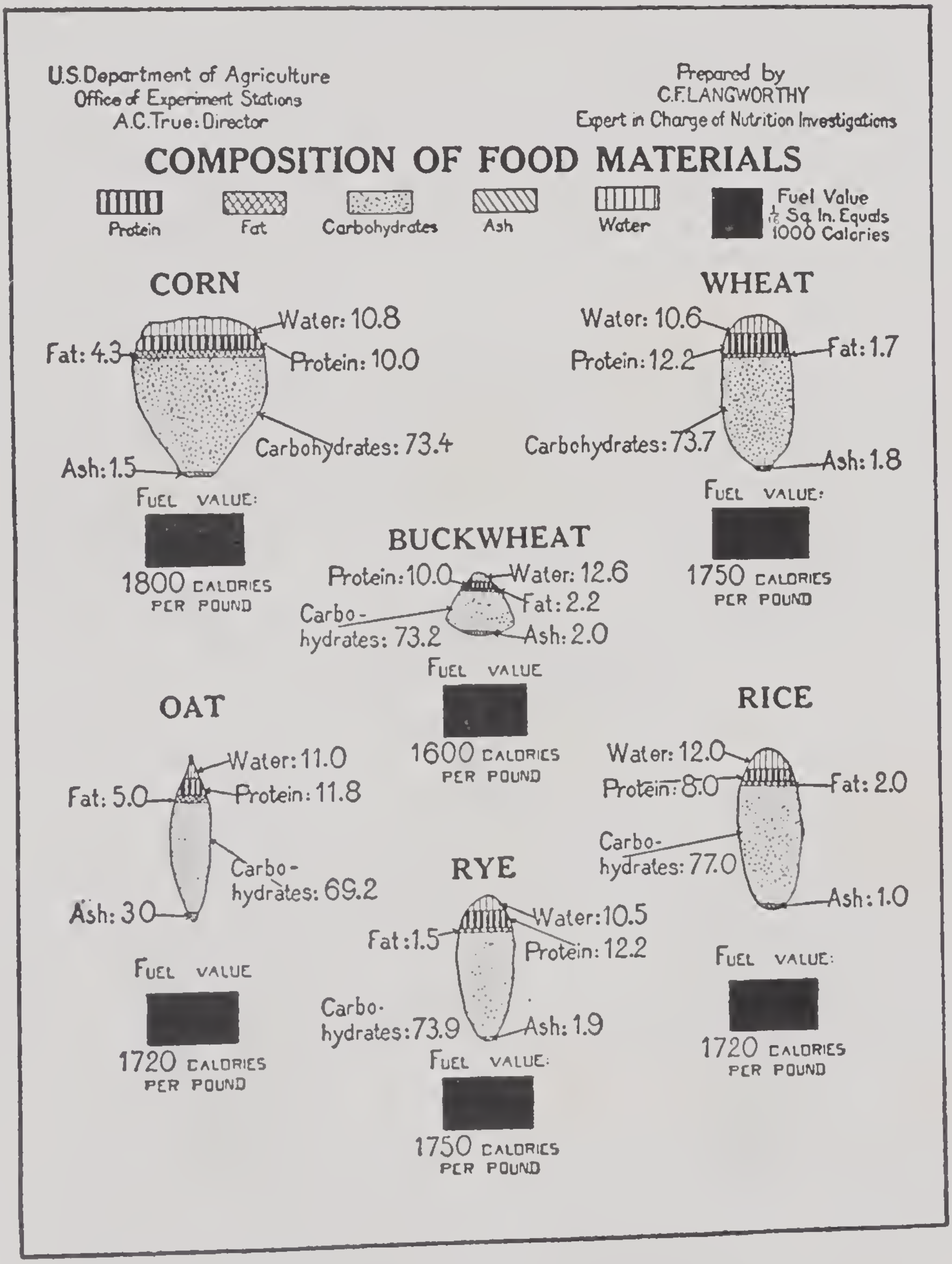
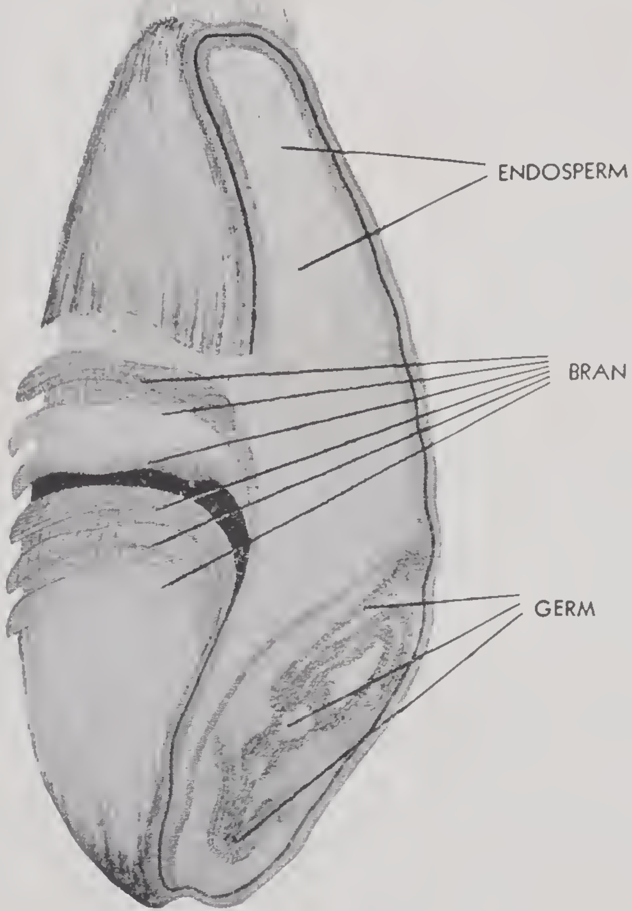


Fig. 19.—Composition of cereals.

Cereal grains are similar in structure, and consist of three parts, the bran coat, the body of the grain or endosperm, and the germ. In the process of milling the bran layers and germ are removed. Unfortunately, this results in a flour or starch essentially devoid

Food Value in a Grain of Wheat

Note that wheat germ is one of the richest known natural sources of vitamin B_1 (thiamin)



Endosperm: The white center of the wheat berry composed mainly of . . . starch (*and also proteins*) . . . excellent source of energy

Bran: The husk and brown layers just beneath; a natural regulator. Rich in . . .
- iron . . . builds red corpuscles
- phosphorus . . . helps build bones and nerve tissue
- protein . . . builds and repairs muscle tissue
- vitamin B_1 . . . (see below)

Germ: The yellow plant germ or embryo, the part which sprouts when the wheat berry is planted. One of the richest known natural sources of . . . vitamin B_1 . . . essential for: normal appetite, growth and development, metabolism of every living cell, metabolism of carbohydrates, normal tonicity of the gastro-intestinal tract, preventing disturbances of the nervous system which, in acute deficiencies, result in beriberi.

Fig. 20.—Food value in a grain of wheat. (Courtesy of the Ralston Research Laboratory.)

of minerals and vitamins. The following tabulation gives the percentages of protein, carbohydrate, fat, and other constituents in the various parts of the wheat:

	PERCENTAGE				
	PROTEIN	CARBOHYDRATE	FATS	FIBER	MINERALS
Endosperm	10-12	76	1	0.25	0.40
Bran	16	44	3.5	18.0	6.0
Germ	25-40	30-50	8-15	1.8	5.7

The current tendency on the part of the millers to "restore" flour is an important step forward.

Since 1941, under the stimulus of the National Research Council, there have been several changes made, each of which brings about an increase in the nutritive value of breads and flour.

In the most widely used method the crystalline vitamins are added, giving an "enriched" flour. To be sold as such, flour must conform to certain specifications. An "enriched" flour *must* contain thiamine, niacin, riboflavin, and iron within the amounts given below and *may* in addition contain calcium and vitamin D.

The newer standards proposed for enriched flour differ from the original. The increases are designed to keep pace with the changes in the knowledge of dietary needs, according to evidence presented by technical authorities (from food industries and representatives of the Food and Nutrition Board of the National Research Council).

TABLE 17

ENRICHMENT STANDARDS*

(Milligrams per pound unless otherwise stated)

	FLOUR MIN.	STANDARD MAX.	BREAD MIN.	STANDARD MAX.
Required				
Thiamine	2.0	2.5	1.1	1.8
Riboflavin	1.2	1.5	0.7	1.6
Niacin	16.0	20.0	10.0	15.0
Iron	13.0	16.5	8.0	12.5
Optional				
Calcium	500	1,500	300	800
Vitamin D (U.S.P. unit)	250	1,000	150	750

*Figures from the National Research Council Bulletin No. 110 (1945).

The bread enrichment program is a definite step forward in government encouragement for better national nutrition. En-

riched bread and flour are unchanged in flavor and compare favorably with the coarser whole wheat products. Without enrichment many more American diets would be low in thiamine, riboflavin, niacin, and iron. In addition, bakers may and many do add milk solids, wheat germ or soya flour. The addition of milk solids improves the protein quality, adds calcium, riboflavin,

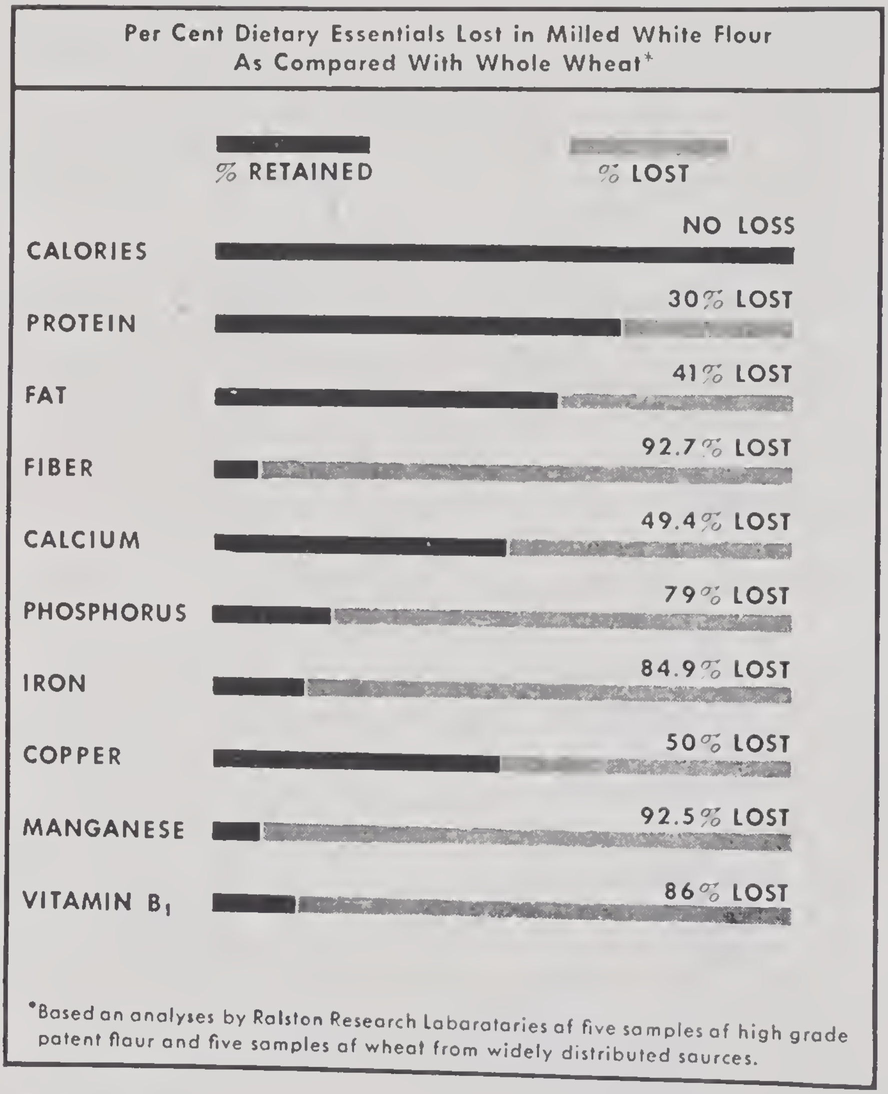


Fig. 21.—Dietary essentials lost in milling. (Compiled by the Ralston Company.)

and improves flavor. The combination of vitamin and milk enrichment is highly desirable. At the beginning of 1946 eighteen states, Hawaii, and Puerto Rico have enacted bread and flour enrichment laws (Alabama, Arkansas, Georgia, Indiana, Kentucky, Louisiana, Maine, Mississippi, New Hampshire, New York, North

Carolina, North Dakota, South Carolina, South Dakota, Texas, Washington, West Virginia, and Wyoming).

Bread is 60 per cent flour. The thiamine, niacin, and iron in yeast breads are but slightly affected by baking. A pound loaf of bread yields 18 slices.

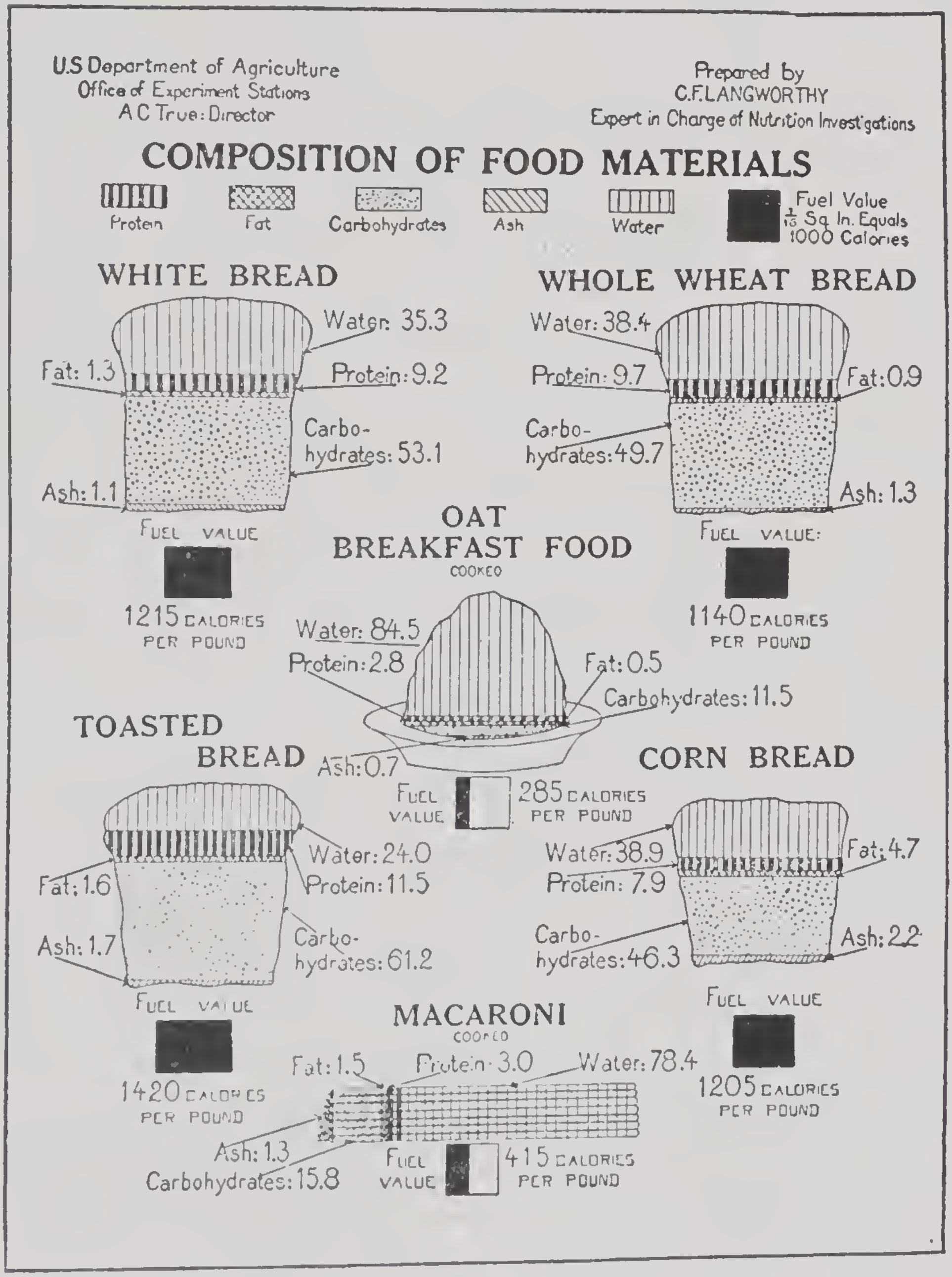


Fig. 22.—Composition of bread and other cereal products.

We may look forward to many changes in the potency of cereals and cereal products now that the practice of "restoration" of essentials lost in milling processes has begun.

Graham flour is the whole wheat kernel ground

Entire wheat flour (contrary to what the name would indicate) is prepared from wheat minus some of the five or six outside bran layers.

Macaroni, spaghetti, and vermicelli are prepared from wheat with a high gluten content. Some is now available in the enriched form.

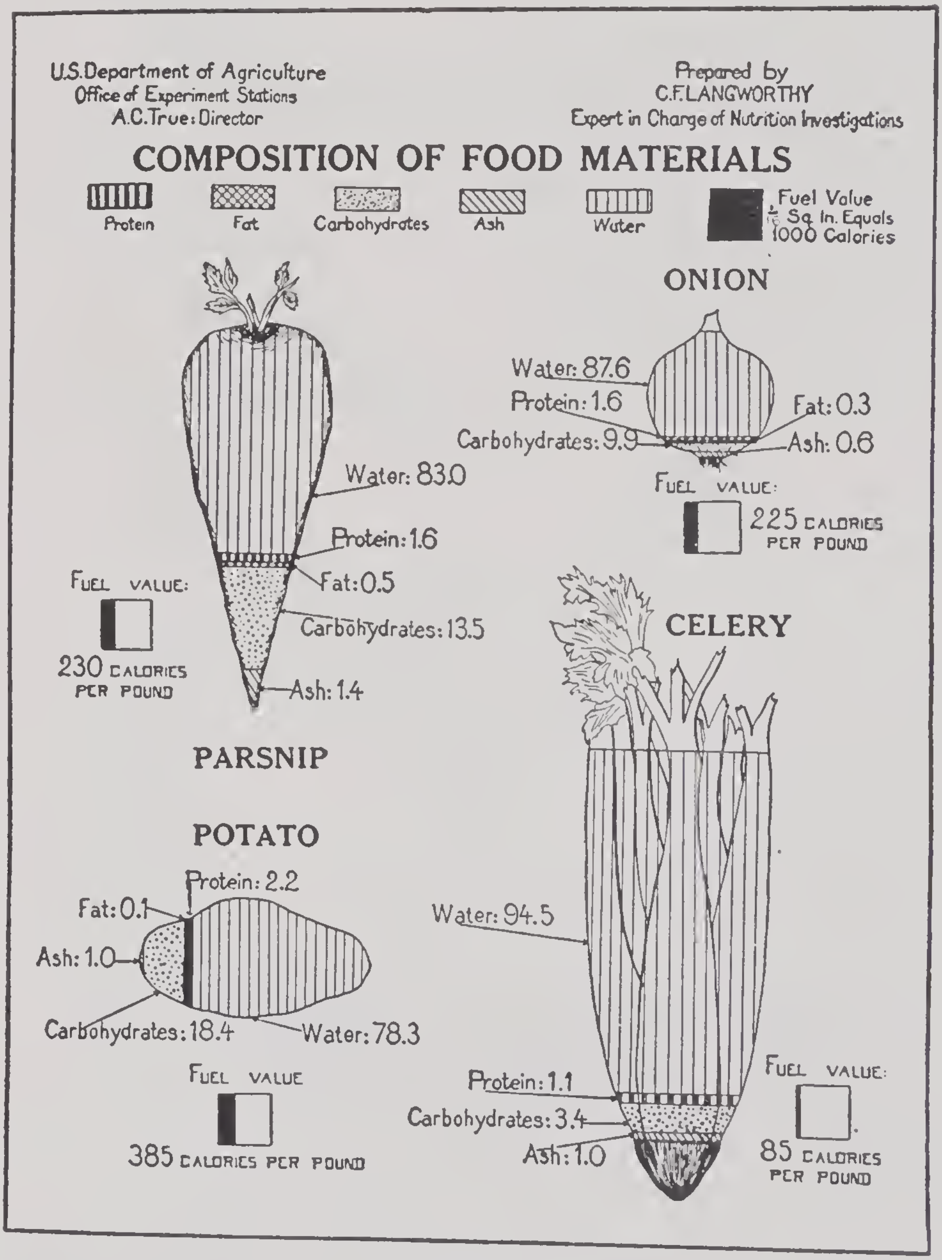


Fig. 23.—Composition of vegetables.

Corn is similar in structure to wheat, but differs in its protein. The proteins of corn are zein and glutelin. Corn contains less protein, minerals, and cellulose than wheat, but has more fat and

carbohydrate. Since the cellulose of corn is low (1.7 per cent), none but the outer skin need be removed before milling.

Cornstarch and corn syrup are prepared from the endosperm of the corn, the first by fine grinding, and the second by hydrolysis of the cornstarch by dilute acid.

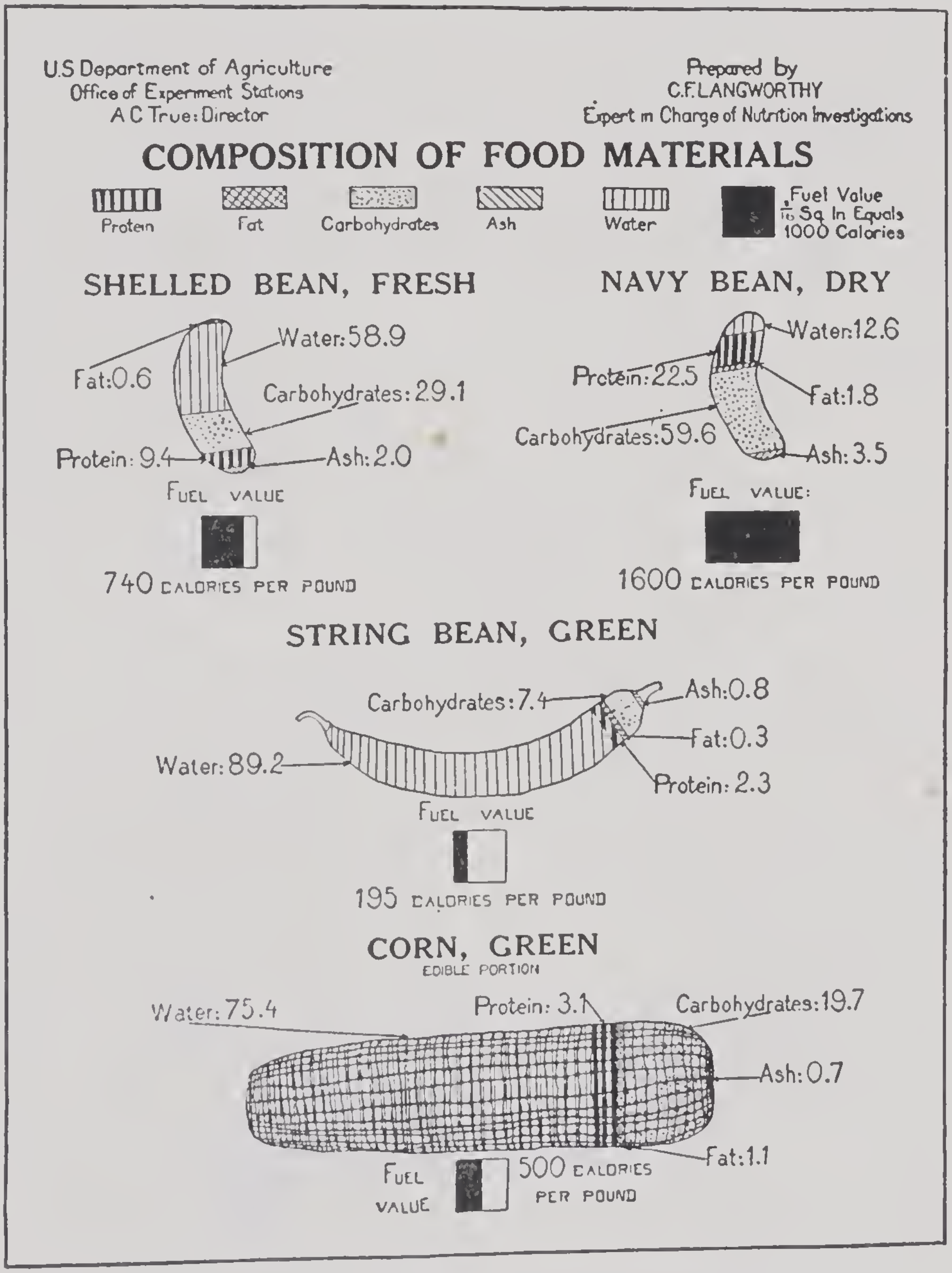


Fig. 24.—Composition of legumes and corn.

Today numberless cereal products are available, puffed, flaked, kernels, finely ground, and others. All have their place in the diet, and all lend variety. Labels should indicate the composition. Recently manufacturers have added vitamins or minerals, or have

irradiated their products. The ready-to-serve, packaged, and fortified cereals are naturally the more costly, and certain preparations have a slightly lower nutritive value, due to the high heat used in their preparation, than the original grain.

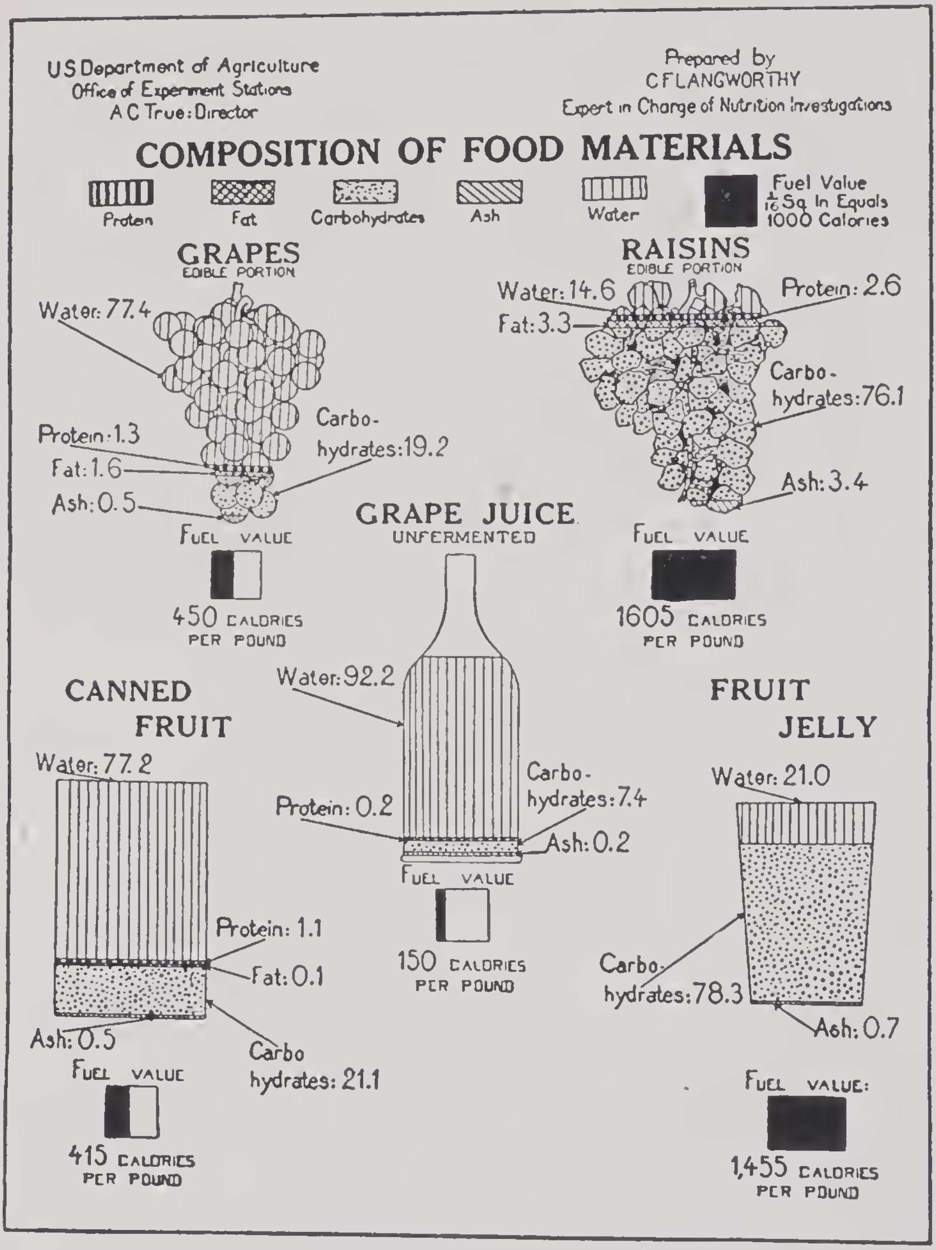


Fig. 25.—Composition of fruits and fruit products.

The statement is occasionally made that oatmeal causes rickets. A brief explanation may be in order. Cereals do contain phytic acid, which has the power to combine with calcium, thus converting the calcium into a nonutilizable form (a phytate). Cereals also contain an enzyme phytase which can hydrolyze this

phytate. The amount of the phytase present in cereals is variable. Oats have little, wheat much more, and rye more than wheat. Long cooking, as in the cooking of old-fashioned porridge, destroys this enzyme, thus preventing its normal action of break-

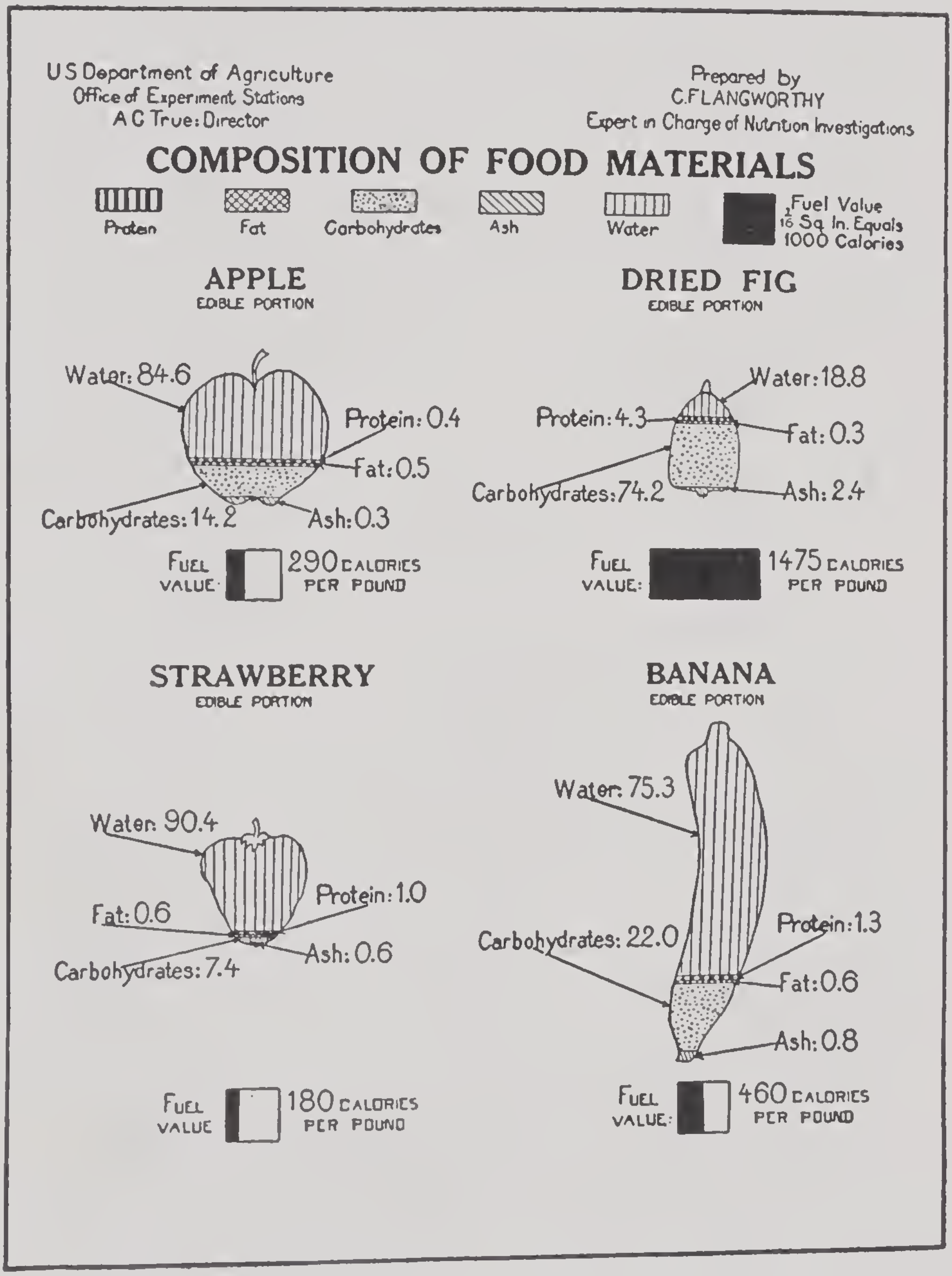


Fig. 26.—Composition of fruits.

down of the phytate and release of the calcium. The shorter cooking time coupled with the higher content of enzyme in other grains results in greater release of calcium. Therefore, the studies which showed that rickets could be produced on a diet containing a large amount of oatmeal gave rise to a popular

misinterpretation of facts. Practically, it is not of importance for human beings who eat diets of variety rather than subsisting almost entirely on the old-fashioned oatmeal.

The **vegetables** may be divided into two main classes, roots or tubers, such as potatoes, onions, beets, turnips, parsnips; and green leafy vegetables, such as cabbage, lettuce, celery, etc. The first group differs from the second in that it has a higher calorie value because of the starch-sugar content, and in general a lower mineral and vitamin content. Vegetables are further subdivided according to their carbohydrate content into 5-10-15-20 per cent vegetables, indicating that 5-10-15 or 20 gm. of carbohydrate is contained in 100 gm. or in approximately ½ cupful of vegetables, or even 3-6-9-12-15-18 per cent vegetables. The composition is variable with the soil on which they are raised, variety, season, and handling, and these divisions are therefore only *approximate.* Such a grouping will be found in the appendix.

Vegetables are rich sources of minerals and vitamins.

Fruits may likewise be grouped according to carbohydrate content. Some fruits like bananas, dates and figs have high fuel value. Others like watermelons, pears, strawberries, and rhubarb have low caloric value. In general, fruits have less than 2 per cent protein, and except for avocado pears and olives, have less than 2 per cent fat. Their carbohydrate content varies from 5 to 20 per cent in the fresh fruits and from 60 to 80 per cent in the dried fruits.

Fruits are rich sources of vitamins and minerals (see discussion under these headings). They owe their distinctive flavors to the volatile oils and acids. The malic acid in apples, tartaric in grapes, citric in lemons, oxalic in tomatoes, are formed in the breakdown of the starches. Fruits are valuable in preserving the alkalinity of the blood, since they form alkaline carbonates during the digestive process. During the ripening of fruits, the starch is converted into sugars, at which time they become readily digested.

The role played by vegetables in the diet is so similar to that of fruit that they may generally be used interchangeably.

The major difference between the two groups is that of the form in which the carbohydrate exists. In fruits—in the ripened stage—the carbohydrate is sugar, in vegetables it exists as a

starch. In addition, most fruits have a mild laxative action. These differences may be used clinically but have no significance in the normal diet.

The dark-green and orange-red vegetables and other "greens," spinach, kale, sweet potatoes, tomatoes, apricots, broccoli, and fruits, are especially rich sources of carotene—the substance from which vitamin A is formed. Roughly the degree of potency corresponds to the depth of color. In general, there is less destruction of vitamin A in handling and cooking than of the other vitamins, as can be seen from the charts below.

The leafy vegetables, citrus fruits, tomatoes, strawberries, and green peppers are excellent sources of vitamin C when freshly harvested. The instability of this vitamin renders it readily destroyed by heat, oxygen, alkali, or through dissolving out. Care must be exercised in the handling of vegetables for maximum vitamin retention. The vitamin C is stabilized in the citrus group and tomato due to the presence of the fruit acids. Most "greens" are also good sources of calcium, iron, iodine, and riboflavin. Any of these facts is a good reason for the daily inclusion of the "tossed green salad."

Interesting data are assembled by the Westinghouse Electric and Manufacturing Company on the Importance of Protective Vitamized Cooking. We quote the following with their permission:

> How the tests were conducted and the results which were obtained make a most interesting story. Four typical, common vegetables were selected, namely—peas, carrots, potatoes, and broccoli, representative of the four kinds of vegetables. All tests were conducted under exactly the same conditions, with the exception of cooking method. Vegetables were identical in quality and freshness and purchased from the same sources. Each sample cooked weighed one pound, precisely 454 grams.
>
> It is generally known that the three principal enemies of vitamins are water, heat, and air. Some vitamins are easily dissolved by water, some are destroyed by air (oxygen) and others by heat. Therefore the amount of water used, the length of time that heat is applied, and the amount of air that can get into the food obviously affect the rate and amount of vitamin destruction in cooking. For this reason the cooking methods used in connection with this research project were as follows:
>
> 1. By modern, protective VITAMIZED COOKING following these four simple rules—

Use little or no water.
Start fast—cook quickly.
Avoid violent boiling.
Use covered utensils—don't stir.

2. By improper or old-fashioned methods involving—
Sufficient water to cover vegetables.
Continuous boiling.
Loose fitting covers on utensils—No stirring.

You will be interested in knowing that only the most modern, scientific methods were used in making the laboratory tests. Samples of all vegetables were chemically and microbiologically assayed for vitamin content, both before and after cooking. Just how these determinations were made is quite technical in nature, and for that reason we will not burden you with the details. However, the results of these tests are important to you because they point the way toward serving more nutritious food to our families.

Scientists determined the degree of vitamin and mineral retention in each of the four vegetables when cooked by VITAMIZED COOKING and by the improper cooking method.

The studies showed conclusively that improper cooking results in substantial losses, whereas VITAMIZED COOKING results in significantly greater retention of vitamins.

To be specific, VITAMIZED COOKING saved an average of 91.0% of vitamins A, B_1, C, B_2 (G) and Niacin (formerly called nicotinic acid) as compared with an average loss of 33.7% of the same vitamins, in the case of improper cooking. Following is a complete summary of the results of the tests.

VITAMINS	VITAMIZED COOKING SAVED	IMPROPER COOKING	
		Retained only	Actually *Lost*
VITAMIN A (Carotene) in peas, carrots, and broccoli	96.1%	94.0%	6.0%
VITAMIN B_1 (Thiamine) in peas, potatoes and broccoli	94.4%	58.0%	42.0%
VITAMIN B_2 (G) (Riboflavin) in peas, potatoes and broccoli	90.4%	59.9%	40.1%
VITAMIN C (Ascorbic Acid) in peas, potatoes and broccoli	76.4%	58.3%	41.7%
NIACIN (Nicotinic Acid) in peas, potatoes, broccoli, carrots	97.5%	61.3%	38.7%

Results of the tests, considering the individual vegetables separately, show the following significant savings which were effected by VITAMIZED COOKING.

Saved in Peas

90.0% of vitamin A
93.3% of vitamin B_1
92.8% of vitamin B_2 (G)
85.3% of vitamin C
97.1% of niacin

Saved in Potatoes

95.3% of vitamin B_1
97.6% of vitamin B_2 (G)
96.3% of vitamin C
99.0% of niacin
Not tested for vitamin A, only insignificant amount present.

Saved in Broccoli

99.0% of vitamin A
95.4% of vitamin B_1
73.4% of vitamin B_2 (G)
67.0% of vitamin C
87.2% of niacin

Saved in Carrots

95.9% of vitamin A
99.2% of niacin
Carrots rich in these vitamins, others not tested.

As far as minerals are concerned, tests showed an average retention of 89.9% to 97.4% of calcium, phosphorus and iron in vegetables tested.

Obviously, jams and jellies made from fruits and sugar are concentrated carbohydrate foods. By the time the fruit has undergone the preparation and cooking process, in addition to "dilution" with sugar, the vitamin value has been markedly reduced. Since such foods have little more than calorie value, they should not be permitted to crowd out foods which will supply not only calories but vitamins and minerals as well.

Nuts properly belong to the fruit group, but because of their composition are discussed in the chapter on Fats.

Review Questions

What are the carbohydrates chemically?

Into what main groups are they classified?

Into what classification should the following be placed? Glycogen; lactose; corn syrup; cellulose; honey; cane sugar; dextrins; pectin; agar-agar.

What may be said about the digestibility of the sugars? The starches?

Approximately what percentage of the normal diet is furnished by carbohydrates?

What is an "enriched" flour or bread?

How are fruits and vegetables classified according to carbohydrate content?

CHAPTER VII

DIGESTION

For those who may wish to review the physiology of digestion, a short discussion is offered in this chapter.

Food, in general, is not available to the body tissues until it has undergone breakdown into its component parts. This preparation of food for cell use is known as **digestion.** The process by means of which these breakdown products pass through the wall of the gastrointestinal tract into the blood stream is called **absorption.** Once in the blood, these constituents are carried to all cells of the body and are utilized as needed.

The digestive process is essentially hydrolytic. The active agents which bring about these changes are known as enzymes. These enzymes are specific in action, act within certain acidity (pH) ranges, and, in many instances, are descriptively named. An enzyme may be defined as an organic substance which is produced by the living cells and has the ability, when mixed with other organic material, to bring about certain chemical changes.

Through the act of mastication, food is broken down into small particles, is well moistened with saliva, and is prepared for the action of the digestive enzymes.

Saliva is the first secretion of the gastrointestinal or digestive tract. It is poured into the mouth from several glands.

Saliva contains two enzymes, ptyalin or salivary diastase, and maltase. Ptyalin acts upon the starches, provided they have been properly cooked, and changes them to maltose. While cooking has no digestive action upon starch, it does render it easier to digest by rupturing the starch granules (see illustration under discussion of carbohydrates). Ptyalin has little effect upon raw starch. The sweetish taste which develops when a bit of cooked starch is held in the mouth is evidence of the change from starch to dextrins (intermediary products in the breakdown to maltose), as the result of enzymatic action.

The discharge of saliva (there may be 1,000 to 1,500 c.c. daily) is under psychic control. Even the sight or thought of palatable food, especially when hunger is present, nor-

mally results in the "mouth watering." Animal experiments indicate that as the mouth waters, or saliva gathers in expectation of work to do, so are the digestive juices in other regions of the

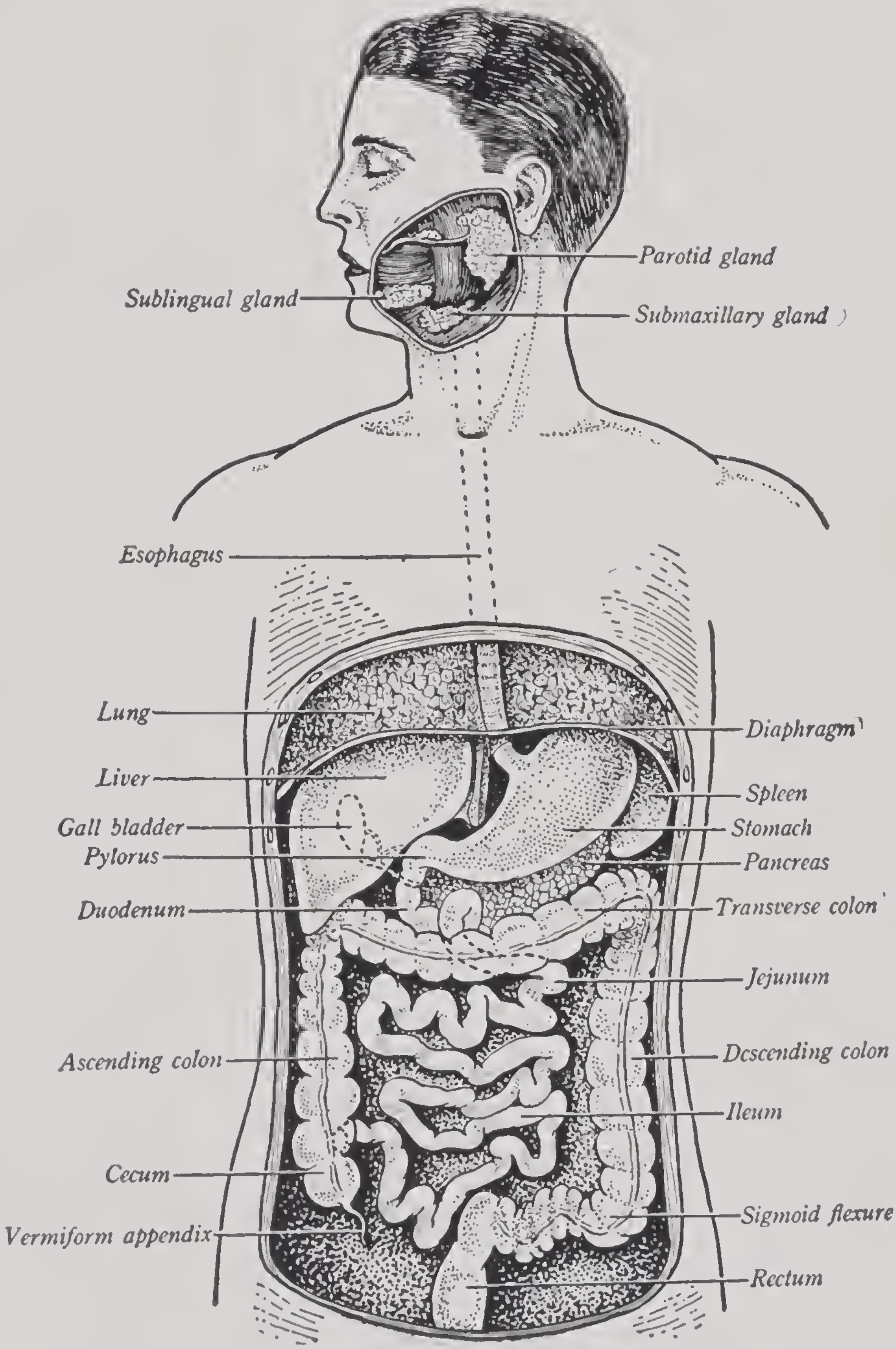


Fig. 27.—Alimentary canal with digestive glands. (From Kirkpatrick and Huettner: *Fundamentals of Health*, Ginn and Co.)

digestive tract summoned for action. The actual tasting of palatable food intensifies this effect. The end result is optimum digestion. This is an important factor in meal planning. Pleasant

anticipation of meals and enjoyment during meal time are also important factors. It can be further demonstrated that anger, fear, or extreme fatigue are factors in retarding the secretion of digestive juices and normal digestive activity.

Saliva also contains traces of maltase which converts any maltose to glucose.

The action of saliva, begun in the mouth, is continued in the stomach until such time as the acidity of the gastric juice permeates the food mass and stops salivary action. Saliva is not far from neutral in reaction, and its activity is inhibited by highly acidic or basic conditions.

From the mouth food passes down through the esophagus or gullet to the **stomach**, in approximately five seconds, by means of wavelike propulsive motion, known as peristalsis. A contracted band at the end of the esophagus, called the cardia or cardiac sphincter, guards the entrance into the stomach. This sphincter is relaxed by the oncoming wave. The stomach is not of definite size, but is an elastic organ adjustable to the volume of its contents.

Contrary to popular belief, the stomach is less a digestive organ than a reservoir. It is true that important protein digestion takes place there, but its more important job is that of slowly admitting food into the small intestine where the major act of digestion is carried on.

It is said that the **gastric juice** appears on the lining of the stomach as profuse perspiration appears on the skin. It is secreted in the fundic end of the stomach (the upper or cardiac end) as a clear, watery fluid, in amounts of two to three quarts daily. It contains 0.2 to 0.4 per cent hydrochloric acid and is, therefore, strongly acidic. Abnormally high acidity is known as hyperacidity or hyperchlorhydria, and abnormally low acid content is known as hypoacidity, hypochlorhydria, or achlorhydria (absence of hydrochloric acid). At the lower end of the stomach (the antrum or pyloric end) the juice is neutral or slightly alkaline.

The production of gastric juice, as well as other digestive juices, is subject to hormonal control. A hormone may be defined as a substance which cells in one part of the body produce and pour into the blood stream for action elsewhere. The first of these hormones of the digestive tract, in order from above down, is gastrin. Gastrin, as its name implies, acts in the stomach.

It is formed in the lower part of the stomach and the upper part of the small intestine in response to the mechanical pressure of food. It is absorbed into the general circulation and goes to all tissues of the body. Only one section responds, however, the lining of the stomach where the stimulus originated. The stomach continues to secrete gastric juice as long as food is in the stomach. When food is no longer present, gastrin ceases to be produced, hence gastric juice production ends. As a result of this hormonal control the secreting cells have periods of rest.

Pepsin is the most important constituent of the gastric juice. In the presence of hydrochloric acid pepsin acts upon proteins and reduces them to cleavage products known as proteoses and peptones (see classification of protein, Chapter IV). These cleavage products are later reduced to amino acids by the intestinal juices.

The gastric juice also contains rennin, the substance which gives the stomach the power to curdle milk. The commercial rennins, such as Junket, which also curdle milk, are prepared from the lining of the calf's stomach. Paradoxically, when rennin in the presence of calcium acts on the casein of milk, it renders the milk insoluble, rather than more soluble, which is the usual enzyme action. This change, however, slows up the digestion of milk in the stomach and ultimately prepares it for further digestion in the intestinal part of the digestive system.

Gastric lipase, which acts on the fats, is the fourth digestive ingredient. The value and extent of the juice is a somewhat controversial matter. Some emulsification of the fats takes place in the stomach, but fat digestion at this point is essentially nil.

In the stomach absorption of water, salts, sugar, alcohol, and certain drugs may take place, but absorption is really a function of the small intestine.

Mechanical pressure is exerted by stomach muscles on the food while it is in the stomach, but the food is not churned and mixed in the manner of popular thought. These movements take place in orderly fashion. The fundic end of the stomach acts as a storehouse for food which in the pyloric end of the stomach is subjected to active digestion. At the pyloric or antrum end of the stomach the food is thoroughly mixed with gastric juice and is broken up by this process and by the mechanical action of the stomach musculature. When this action is complete, and the stomach con-

tents are well acidified, relaxation of the sphincter guarding the stomach-intestinal junction (the pylorus) takes place. This opening of the pylorus is activated by the consistency of the food mass, by the tension of the stomach muscles, by fullness or emptiness of the duodenum, and by peristaltic waves within the stomach. As the fluid or semifluid mixture of food material, known as chyme, passes down through the pyloric sphincter, the upper portion of the stomach slowly contracts upon the food mass held there, and forces it down into the lower portion, where more active digestion takes place.

The length of time food remains in the stomach is dependent upon several factors. The stomach may be emptied in one hour, or emptying may require six or seven hours. A carbohydrate meal leaves the stomach more rapidly than does a protein meal which in turn leaves the stomach more quickly than a meal of fat. Fat, in quantity, depresses the flow of gastric juice and slows up the emptying time. The average time required for the stomach to discharge an ordinary meal is three to five hours. Psychic factors, however, may interfere with this time.

The third section of the digestive tract is the **intestines**, which are divided, structurally, into two main parts, the small and large intestine, the latter being also called the colon. The first ten inches of the small intestine, adjacent to the stomach, is known as the duodenum; the next eight feet as the jejunum; and the remainder as the ileum. There is no marked difference in these sections. At the junction of the small intestine and large intestine is the ileocecal valve or sphincter, and a small pouch called the cecum, at which point is situated the vermiform appendix. The ileocecal sphincter prevents too rapid passage of material from the small intestine into the large intestine, and also prevents the back passage of fecal matter. Passage of material through this valve is sometimes spoken of as internal defecation.

As can be seen from Fig. 27, the colon may be considered as sectional—ascending, transverse, and descending colon, the S-shaped curve known as the sigmoid; and finally the straight strip, the rectum, which ends in the anal sphincter, the anus.

The small intestine is about one inch in diameter and about twenty feet in length. The large intestine is about two inches in diameter and five feet in length.

Digestion is most active in the small intestine. Here again hormonal, chemical, and mechanical factors work together. Under the influence of the acid food mass upon the mucous membrane of the duodenum, a hormone known as secretin is produced, which reaches the pancreas by way of the blood and stimulates it to secrete pancreatic juice.

In the same region of the intestinal wall from which secretion arises two other hormones are produced. One, enterogastrone, inhibits the motions of the stomach; it prevents the stomach from emptying a fatty meal too quickly—before the intestine is ready to receive it. This is a hormone with an inhibiting rather than a stimulating effect. Inhibiting hormones are known as chalones.

Another hormone, cholecystokinin, is produced when fatty food comes in contact with the intestinal wall, and stimulates the gall bladder to discharge its bile.

Pancreatic juice, bile and intestinal juice are poured almost simultaneously into the duodenum about three to four inches below the stomach-small intestine junction (or pyloric sphincter). These juices mutually interact upon each other and upon the incoming food.

The **pancreatic juice** contains three enzymes: (1) Pancreatic diastase, which is similar in action to ptyalin of the saliva. It is also known as amylopsin or amylase. It is capable of splitting starch to maltose. Even uncooked starch can be hydrolyzed to a slight extent by this enzyme. However, uncooked starch is only slowly acted upon and when large amounts are included in the diet, the major portion will appear unchanged in the stool. (2) Lipase, or steapsin, whose work is the emulsification of unemulsified fats and the breakdown of these fats into fatty acids and glycerin (glycerol). (3) Trypsin, the protein-splitting enzyme, or more correctly the inactive form of trypsin—its precursor trypsinogen. This enzyme, as it appears first in the pancreatic juice, has no digestive power. It becomes activated by an admixture with the "activator," the enterokinase of the intestinal juice, and is thereby rendered capable of breaking down the protein molecule to its smallest component part, the amino acids. Unlike pepsin it does not require hydrochloric acid for its action, and it is capable of completing the cleavage of the protein molecule.

The extreme activity of enzymes is demonstrated by a study at Columbia and quoted by Dr. Sherman in *The Science of Nutrition*. In 30 minutes at body temperature, pancreatic amylase digested, roughly, 20,000 times its weight in starch and about 10,000 times its weight in maltose. Tested over a longer range of time, it digested 4,000,000 times its weight in starch and 2,800,000 times its weight in maltose before becoming completely inactivated. This activity was at a dilution of 1 to 100,000,000 parts of water. This enzyme and others have been prepared in crystalline form and are proteins.

The **intestinal juice**, succus entericus, or duodenal juice, also contains three types of enzymes. The amylases, sucrase (also called invertase), maltase, and lactase, convert cane, malt, and milk sugars into simple sugars. Erepsin carries out the later stages of protein digestion by the reduction of proteoses and peptones to amino acids. Enterokinase, as indicated, converts the inactive trypsinogen into active trypsin.

Bile has the power of markedly increasing the solubility of the fatty acids and of diminishing the surface tension between watery and oily fluids. It is not a digestive enzyme in the strict sense of the word. About one pint of bile is poured into the duodenum daily. When for any reason this does not occur, fat absorption is halted and fatty acids are excreted in the stool; both fat and fat-soluble vitamins are thereby lost. Bile also has a retarding action on intestinal putrefaction and stimulates peristalsis.

Absorption takes place readily from the small intestine, and the greatest part of the available nutrients are, therefore, absorbed before the intestinal contents reach the large bowel. The final products of digestion, the amino acids from proteins, the fatty acids and glycerol from fats, and the monosaccharides from carbohydrates, are formed slowly and at varying times in the digestive process, and these constituents are taken up by the blood as they become available. Too great concentration at any one place or at any one time is thereby prevented.

The physical make-up of the small intestine renders it highly specialized for the duty of absorption. Examination reveals the presence of many cross folds, visible to the naked eye. Under the microscope countless tiny fingerlike projections or villi are seen, much like the nap on velvet. These make it possible for in-

numerable epithelial cells to come in contact with the intestinal contents. Here again the efficiency of hormonal control is evident. Villikinin stimulates the villi of the intestine to wave more rapidly. This makes it possible for the villi to conserve energy when food is absent from the intestinal tract.

On the inside of the intestinal wall is the intestinal contents, on the outside of the membrane is lymph bathing the cells, and running about both are the capillary vessels carrying blood. The major part of the digested food particles "soak" through the epithelial cells of the villi, pass through the lymph, and enter the capillaries. Part of the fat, however, remains in the lymph and reaches the blood stream via the lymphatic system and the thoracic

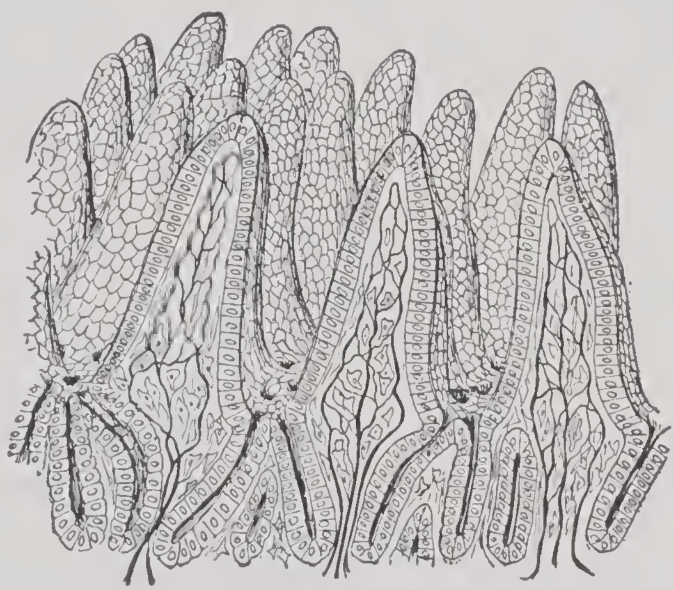


Fig. 28.—A bit of the lining of the small intestine is shown cut through and extending away from the observer. The eminences are villi with capillary nets inside; the slender pits are glands. (From Stiles: *Human Physiology*, W. B. Saunders Co.)

duct (see Lymph, Chapter VIII). Although the fat is broken down in digestion into fatty acid and glycerin, and in such forms passes through the intestinal cells, it is immediately reconstructed into tiny droplets of fat and carried in the lymphatics (or lacteal tubes). When fat-laden, lymph has a milky appearance. The milky fluid is known as chyle.

Just as food is carried after swallowing (deglutition) into the stomach by **peristaltic action**, so it is propelled throughout the length of the gastrointestinal tract. At intervals it is pushed back by an antiperistaltic wave, only to be carried forward again and further admixed by rhythmical movement or series of local con-

strictions. These three types of movement produce ideal conditions for digestion and absorption throughout the small intestine.

In the **large intestine** the residual matter becomes more and more solid as it passes toward the anus. Very little absorption other than of water takes place here, and no digestive process. The large intestine is a storehouse for the convenience of the active small intestine much as the stomach is a storehouse.

The **feces** or stool contains the end products of the ingested food which are, however, only a fractional part of the total fecal mass. Bacteria, bits of epithelial cells, remnants of digestive juices, products of bacterial decomposition, inorganic salts, and traces of undigested food, all go to make up the mass. The volume of fecal matter passed daily is variable, but on an average diet it is between 100 and 400 gm. as moist weight, or 25 to 100 gm. of dry material.

A far larger percentage of food is digested and absorbed than is generally realized. On an average 95% of all edible foodstuffs is digested and absorbed, 92% protein, 95% fat, and 98% carbohydrate, according to studies made by Atwater.

Approximately eighteen to twenty-four hours elapse from the time of ingestion of food and final elimination of its waste products in the stool. As long as four to five days, however, is not altogether uncommon.

Bacterial action in the intestinal tract may become a matter of importance. At birth the digestive tract is sterile, and in adult life it is estimated that perhaps one hundred billion bacteria may act upon the intestinal contents daily. The action may be either harmful or beneficial. Under certain conditions attempts are made to alter the type of intestinal flora or bacteria through food adjustment. Putrefaction of proteins and fermentation of sugars, or either alone, may appear if gastrointestinal activity is slowed. Constipation and diarrhea likewise are caused by abnormalities in the digestive tract.

Digestion, complicated as it may be by psychic factors, is dependent upon common sense for its optimum action. The **psychic factors** are too frequently ignored in considering digestive disturbances and in ascertaining the reason for inadequate response to dietary regimen. Any emotion, such as anger, fear, worry, extreme fatigue, or excitement, has a depressing effect on the secretion of digestive juices and normal muscular activity. Appreciation of

this psychic influence is expressed in the term psychodietetics—the cooperative program of the psychiatrist and the dietitian.

Conversely, happiness, pleasant surroundings, and palatable food are favorable to optimum gastrointestinal activity. Health notions and food fads obviously may be influencing factors. Overeating, undereating, bolting of food, food that is too hot or too cold,

TABLE 18

DIGESTION

Mouth:	Breakdown of food into small particles through the process of mastication. *Enzymatic action:* Saliva *Ptyalin*—salivary amylase acts on starches, changing them to maltose. Proteins and fats unchanged chemically.
Stomach:	Mechanical mixing of juices with food by means of muscular contraction. *Enzymatic action:* Gastric juice *Pepsin*—HCl changes proteins to proteoses and peptones. *Lipase* emulsifies fats. *Rennin* coagulates milk. Salivary digestion continues until food mass becomes acidified.
Small intestine:	Mechanical mixing by means of rhythmic contractions, peristalsis and antiperistalsis. *Enzymatic action:* Pancreatic juice. *Trypsin,* secreted as trypsinogen and activated to trypsin by the enterokinase of the intestinal juice, changes proteoses, peptones and polypeptids to amino acids. *Lipase* reduces fats to fatty acids and glycerols. *Pancreatic amylase* changes starch to maltose. Bile from liver renders fatty acids and glycerol water soluble and facilitates their passage across the intestinal mucosa. Intestinal juice. *Erepsin* of the small intestinal mucosa changes peptones to amino acids. *Invertase* (sucrase) changes sucrose to glucose and fructose. *Maltase* changes maltose to glucose. *Lactase* changes lactose to glucose and galactose. *Enterokinase* is the activator of trypsin.
Large intestine:	No digestion; its function is absorption.

excessive spicing, all eventually leave their mark. Postural defects and extreme malnutrition may mechanically interfere with the action of digestion. Good digestion is one of the pillars on which good health must rest.

Review Questions

What function does the stomach perform in relation to digestion?

Where is the greater part of digestion accomplished?

What are enzymes?

Follow the digestion of a glass of milk through the alimentary tract naming the enzymes and the nutrients which they affect.

What is bile?

What physical action combines with chemical action in the digestive process?

How completely are foodstuffs normally digested?

How long does the digestive process take on the average?

In addition to physical and chemical elements, what other factors may affect digestion?

CHAPTER VIII

THE BLOOD AND LYMPH

Inasmuch as alteration in blood composition may result in widespread physiologic changes, it is of value to know the average composition of blood in order to understand better the effects of deviation from the normal averages. *For the sake of easy reference and review, this chapter is included. See appendix for table of values.*

Blood makes up 7 to 8 per cent of body weight—a 70 kilo man would have, roughly 10 to 11 pints of blood. It is a circulating tissue consisting of a fluid portion called plasma, in which are suspended three types of formed elements: the red blood cells (R.B.C.) or erythrocytes, the white blood cells (W.B.C.) or leucocytes (sometimes leukocytes), and the platelets. Dissolved in the plasma are gases and solid materials. The formed elements make up about 45 per cent of the volume of the human blood, the plasma the other 55 per cent.

Blood has eight functions in the body. It carries food material (the metabolic end products of digestion) from the intestines to the tissues, and oxygen from the lungs to the tissues. The food materials are in solution, and the oxygen is carried in loose combination with the hemoglobin of the red blood cells as oxyhemoglobin. Blood carries the waste products to the kidneys, lungs, skins, and intestines, depending upon the point of their elimination from the body. It transports the hormones from the place of elaboration to the seat of action. It brings about a uniform distribution of heat and so aids in the regulation of body temperature. It aids in maintaining acid-base and water balance. Lastly, because of its bacteriologic antibodies, blood forms a line of defense against disease.

When whole blood is spun down in a centrifuge so that the fluid and suspended solid parts are separated, it divides into formed elements and plasma. If it is allowed to coagulate or clot, it separates into formed elements and serum, which is essentially plasma minus fibrinogen, the fibrinogen having been used up in the clot formation (see Clotting).

The erythrocytes or **red cells** are the hemoglobin-containing, and therefore, the oxygen-carrying, cells or corpuscles. The leucocytes or white cells are the disease-resisting cells. The platelets participate in clot formation. The red cells are the heaviest portion of the blood and, therefore, appear after centrifugation as a thick, red, gelatinous mass in the bottom of the tube, while the white cells appear as a thin, creamy layer on top. The platelets are not visible.

The erythrocytes vary in number in normal blood, depending upon age, sex, geographic location, and the degree of activity and hydration of the individual. Approximately 5,000,000 cells per cubic millimeter of blood is the average number for men; the number is slightly less for women. The number present, as well as their physical structure, may be determined by microscopic examination (blood count), and these factors are of diagnostic value.

The hemoglobin (Hb.), a protein-iron compound, is the red coloring matter of the red blood cells. Human blood contains, roughly, 15.6 gm. Hb. per 100 c.c. The iron content of the hemoglobin gives to it the property of carrying oxygen without itself being oxidized. If the percentage of hemoglobin or the total number of corpuscles is below average in number, the oxygen-carrying capacity is affected and anemia results. Hemoglobin unites with oxygen to form oxyhemoglobin, which is a brilliant red. As blood leaves the lungs (arterial blood), it is bright red in color due to this oxygen content. After circulation, with the removal of oxygen by the tissues, and the uptake of carbon dioxide as a tissue waste product, the blood returns to the lung as dark red (or purplish) venous blood due to its low oxygen content, its reduced hemoglobin. In the lungs the carbon dioxide is expelled, oxygen is again taken up, and the blood starts on another trip around the body. A drop of blood makes the complete circuit in about twenty seconds.

Each 100 c.c. of normal plasma—and there are some 3 to 3½ quarts in the adult—contains 7 to 8 gm. of protein. Of this, 60 per cent is serum albumin, 35 per cent is serum globulin, and 5 per cent is fibrinogen. Traces of prothrombin are also present. This protein fraction is of great importance.

Whenever the proteins of the blood are appreciably decreased, serious changes take place. One of the functions of the blood

proteins is to help control the water exchange between the blood vessels and the surrounding tissue. When blood proteins fall, fluid is lost into the tissues and edema or dropsy results. "War edema," "prison dropsy," and "hunger swelling" all express the effect of protein restriction in the diet. Protein deficiency occurs in severe hemorrhage, with extensive burns, in general peritonitis, and in certain gastrointestinal tract disorders where protein utilization is impaired, as well as when the dietary intake is inadequate. Failure to maintain the normal concentration of the plasma proteins results in circulatory failure or "surgical shock." The value of transfusions of plasma in such conditions is well demonstrated by the countless lives saved since Pearl Harbor.

Recently, it has been found practicable to use commercially prepared amino acids or a protein digest when sufficient whole blood or plasma is not available or when higher concentrations of protein are immediately desirable. Amigen (a mixture of amino acids and the smaller polypeptides made by enzymatic hydrolysis of casein and pork pancreas) is such a product. Elman reports having successfully given as high as 400 gm. of this product daily.

It has been shown that for every gram of plasma protein lost, 30 gm. of dietary protein must be used for replacement. Decreased plasma protein reflects tissue protein loss of a far greater extent. This indicates the need for a high protein intake as replacement. This is a matter to which blood donors, especially those repeatedly giving blood, should pay heed. To replace the protein removed by the usual 500 c.c. donation requires approximately 100-120 gm. of protein over and above the normal need.

Expressed as to chemical composition, the blood is made up of 75-80 per cent water, 20 per cent protein, 1-2 per cent fat, 0.1 per cent glucose, about 2 per cent inorganic salts—the sulfates, phosphates, chlorides and bicarbonates of calcium, sodium, potassium, and magnesium—and the nitrogenous substances—urea, uric acid, creatinine, creatine, and ammonia. And, in addition, enzymes, hormones, and immunizing agents.

Clotting of Blood

The mechanism which prevents the complete outpouring of blood which would otherwise occur when a blood-carrying vessel is cut,

is a complicated procedure in which many factors play a part. By means of a chain of events, and the original presence of calcium salts and an antithrombin in the circulating blood, the fibrinogen, which is in soluble form, becomes converted into an insoluble fibrin, a threadlike mass of protein, which enmeshes the blood cells and forms a clot. Vitamin studies have revealed that another factor, vitamin K, is essential. If this vitamin is absent from the blood stream, prothrombin (one of the intermediary substances) is not normally formed, the process of clot formation is interrupted, and the blood fails to clot with normal rapidity. The coagulation or clotting time is prolonged. Administration of vitamin K corrects the difficulty at once (see Chapter X, Vitamin K).

Lymph

Blood is not the only liquid that transports material to different parts of the body. The lymph, a form of blood serum, bathes all body tissues. It is the fluid outside the blood vessels and around the body cells. Lymph between organs and body walls is known as pleural or peritoneal fluid. It is also spoken of as tissue fluid.

Under pressure, fluid seeps through the capillary walls into the outlying tissue—fluid in which minerals and protein are held in solution. The water and minerals are able to reverse their direction and pass back into the capillaries. Not so the protein; unless it were picked up by the lymph it would be a nutritive loss; and too, protein accumulation outside the blood vessels would upset the osmotic pressure and water would likewise be retained, causing edema. The lymph absorbs the protein-ladened filtrate and carries it, along with the fat, back to the blood stream via the thoracic duct.

There are no vessels corresponding to arteries in the lymphatic system; hence there is no real lymphatic circulation. There are, however, channels or tubes (the lymphatics) that begin in the open spaces between a capillary and a cell, through which lymph flows slowly from all parts of the body toward the thorax, where the greater part of the lymphatics, which have been uniting again and again into ever larger tubes, join in forming one big tube, the thoracic duct. This duct empties into the venous blood system at the junction of two large veins in the neck.

Review Questions

Of what is blood composed?

What are its functions in the body?

What are the red cells of the blood called?

What is their function?

What are the white cells called?

What is their function?

What is the average number of red cells per cubic millimeter of blood?

What is hemoglobin? What function does it perform?

When the number of red cells or the percentage of hemoglobin falls below normal, what is the result?

Why is the presence of protein important?

What is the importance of vitamin K in blood clotting?

What is lymph? How does it function?

CHAPTER IX

THE ENDOCRINES AND THEIR ROLE IN NUTRITION

While at first thought a discussion of the endocrines, those organs which secrete powerful regulatory substances into the blood, is outside the realm of nutrition, their hormones are important factors influencing the structural and nutritional condition of the body and should be mentioned briefly. *They are discussed here for those who are interested.*

In the early history of medicine various diseases were attributed to a lack of mysterious substances, supposed to be normally supplied by the various organs. Treatment of such diseases consisted of an attempt to supply the lacking substance. Opotherapy (organtherapy) was the name given to this type of treatment. The brain of a hare was administered for nervousness and liver was given for disorders of the liver. In 1849 Berthold described the effects of castration in a fowl. He showed that implantation of testicular tissue could prevent the onset of the symptoms which follow this operation or could counteract the effect of the castration after these symptoms had appeared, thus proving that there was a secretion produced by at least some of the organs which could cause widespread effects. Borden, a physician at the court of Louis XV, believed that every organ in the body "is a workshop of a specific substance which passes into the blood." He thought that the physiologic integration of the body depended upon these substances. In 1889 Brown-Séquard treated general debility in himself by injections of testicular extracts and reported highly beneficial results.

The name **hormone** (excitor) was given to these secretions under the mistaken concept that they always had a stimulating action. This is not always true, for the action of some hormones may be depressant, or circumstances may determine just how the hormone may act (see Chapter VII, Digestion).

The known **organs of internal secretion** are the pituitary (or hypophysis), the pancreas, adrenals, thyroid, parathyroid, gonads (sex organs), and the intestines. They all produce hormones. The

pineal and thymus glands may possibly belong to this list, although little is as yet known about their secretions. The known hormones are specific and are powerful in their action.

The Thyroid Gland

Distinct abnormalities result when the thyroid gland secretes a hormone which is chemically incorrect, when the secretion is inade-

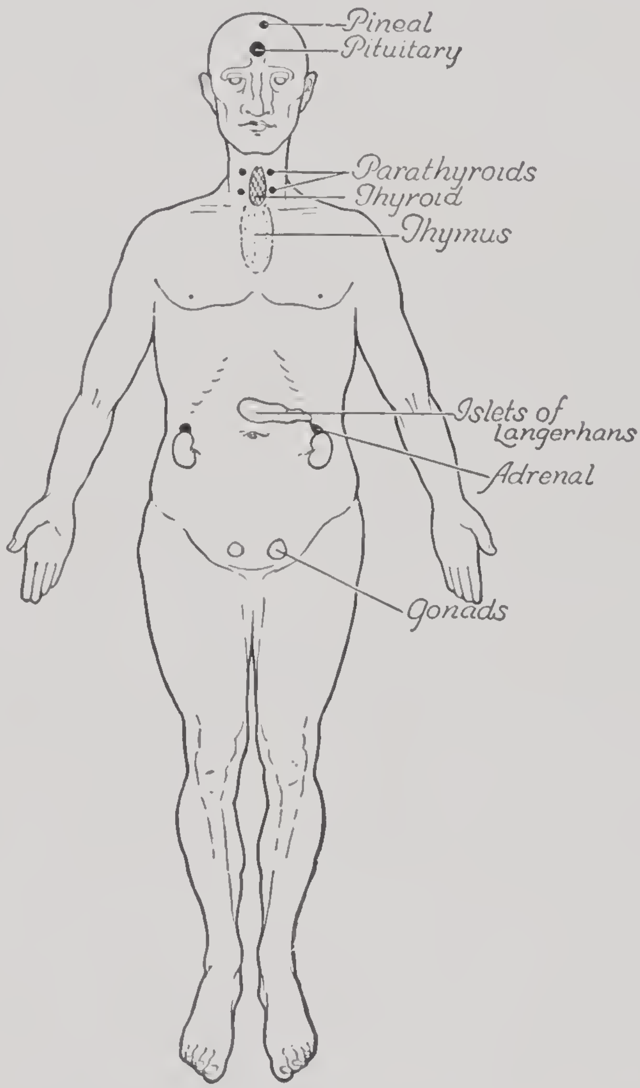


Fig. 29.—Distribution of endocrine glands. (From Williams: *Personal Hygiene Applied*, W. B. Saunders Co.)

quate in amount, or when the supply is excessive. These abnormalities may be divided into three main groups; simple goiter, hypothyroidism, and hyperthyroidism. A **simple goiter** usually develops when the hormone produced has a low iodine content, due to low iodine content of the food eaten. The secretion of the thyroid, known as thyroxin, is an iodine-containing compound (see Chapter

XI, Minerals). The mother substance of thyroxin is the amino acid tyrosine. Tyrosine has been proved to be one of the nonessential amino acids. It can be readily synthesized in the body from the essential, or indispensable, amino acid phenylalanine—a compound of similar structure. The reaction, however, is not reversible. In certain geographic areas, because of the low iodine content of the water and soil, which is in turn reflected in the food, this type of goiter (also known as colloid goiter) is endemic. The thyroid gland may grow to enormous size, up to two pounds or more in weight, probably as the result of an adaptive

A. B.

Fig. 30.—*A*, Case of myxedema; *B*, same after seven months' treatment. (After Tigerstedt, from Baird: *Macleod's Physiology in Modern Medicine.*)

reaction. The gland attempts to compensate for the low quality of the secretion by excessive production. This latent condition is precipitated frequently during periods of physical strain, such as adolescence or pregnancy. Marine, in his classical experiments with large groups of school children, has shown that the occasional administration of iodine to potentially goitrous children, will prevent its development in the large majority of cases. The commercially prepared iodized salt is a logical compensation for low food iodine, especially in goiter belts, and is of value in the prevention of simple goiter.

Hypothyrodism occurs when an insufficient amount of chemically normal thyroxin is produced and thrown into the blood stream. As a result, the clinical condition called myxedema develops. The patient exhibits a characteristic vacuous expression, is slow of speech, and shows general dullness of intellect. There is definite slowing up of all body processes, including the met-

Fig. 31.—Cretin, 19 years old. The treatment with thyroid extract was started too late to be of benefit. (From Bard: *Macleod's Physiology in Modern Medicine.*)

abolic rate, which is, as would be expected, accompanied by weight increase, unless dietary adjustment is made. Where the deficiency existed at birth or soon after, cretinism develops. Myxedema may arise after normal growth and development have taken place.

A. *B.*

Fig. 32.—Illustrating cretinism, *A*, and the recovery, *B*, after the administration of thyroid gland. (Nicholson.)

A. *B.* *C.*

Fig 33.—Patient before and after removal of thyroid gland because of exophthalmic goiter (overactive thyroid). *A*, Before operation. Note thinness, tense expression, protruding eyes, and enlarged thyroid. *B*, Two weeks after operation. *C*, A year after operation. (From Crile: *The Thyroid Gland*, W. B. Saunders Co.)

Conversely, an overactive thyroid gland **(hyperthyroidism)**, with increased outpouring of thyroxin, causes an exophthalmic goiter. This goiter is accompanied by bulging, staring eyes (exophthalmia), extreme nervousness, elevated pulse rate, and weight loss due to the increase in metabolic rate, which may be as great as +80 to 90 per cent in severe cases.

The Parathyroid Glands

For a time the parathyroid glands were not clearly differentiated from the thyroid gland. They are now known to have functions entirely distinct from the thyroid gland. Accidental removal of the parathyroids during thyroidectomy has accounted for numerous cases of tetany (muscular spasm or convulsions). The secretion of the parathyroid glands exerts an effect upon smooth muscle by way of its control of the calcium blood level (see Chapter XI).

The Adrenals

The adrenals, also called suprarenals, one of which is at the upper side of each kidney, produce hormones which play important roles in the body processes. Experimental studies reveal the versatility of action of these secretions. The mammalian adrenal is made up of two parts, cortex and medulla. Each part acts independently. The cortex produces several hormones necessary for normal metabolism. An extract of the cortex is known as cortin. One of these hormones, desoxycorticosterone, is involved in mineral metabolism and, in synthetic form, is used as medication in Addison's disease. Occasionally, due to destructive lesions in the cortex, Addison's disease occurs. Characteristic of this condition are anemia, general languor, debility, feebleness of heart action, and peculiar bronzing of the skin. The symptoms become progressively worse until, without other suffering, the patient dies. The treatment or control, which is not entirely satisfactory, consists in the use of cortical extracts and drastic dietary adjustment in mineral intake. The medulla apparently is concerned in the control of neuromuscular activity. Adrenaline, secreted by the medulla, stimulates glycogenolysis (glycogen breakdown into glucose) in the liver and the muscles so helping to regulate the blood sugar level. Adrenaline is probably formed from the amino acid tyrosine.

The Pituitary

The pituitary (or hypophysis), consisting of two lobes, is a small gland about the size of a large green pea situated at the base of the brain. It produces secretions which have a definite effect on growth and development. The pituitary gland is sometimes called

Fig. 34.—Giants and dwarfs owe their abnormal stature to the overactivity or underactivity of the pituitary gland. (Courtesy Press Association, Inc., New York.)

the "master gland." The hormones from the anterior lobe control growth, metabolism, sex reactions, and lactation. Those of the posterior lobe govern blood vessel tone and urinary secretion. Great advances have been made in the knowledge of the hormones of the

anterior pituitary. A number of these active principles have been extracted and purified.

If there is overactivity of the gland before puberty (which is itself a result of gonadal changes), too rapid structural growth takes place, resulting in gigantism (Fig. 34). When the hyperactivity takes place during adult life, acromegaly takes place (Fig. 35).

Underactivity or failure of the anterior lobe of the pituitary to develop normally results in the reverse condition, dwarfism.

Another clinical manifestation of pituitary insufficiency is Simmonds' disease, in which extreme emaciation and premature aging result.

A. *B.*

Fig. 35.—*A*, The appearance before the onset of acromegalic symptoms; *B*, the appearance after seventeen years of the disease. (After Campbell Geddes, from Bard: *Macleod's Physiology in Modern Medicine.*)

The Pancreas

The pancreas, the long, slender organ lying in the bend of the small intestine, just below the pylorus, produces both an internal and an external secretion. The external secretion (pancreatic juice) is discussed in Chapter VII, Digestion. It is with the internal secretion, insulin, that we are here concerned. Insulin, produced by the islet cells (the islands of Langerhans, so named for their discoverer), controls carbohydrate metabolism. An in-

adequacy of insulin results in incomplete oxidation of carbohydrates, high blood sugar, and excretion of sugar in urine, and disturbance in fat utilization (see Chapter V, The Fats). The condition which results is known clinically as diabetes mellitus or "sugar diabetes." A combination of diet adjustment and hypodermic use of sufficient insulin prepared from animal tissue can compensate for the individual's discrepancy in insulin production, control the clinical condition, and return the individual to a state of health in which he can carry on normal activities.

When excessive amounts of insulin are produced and secreted, abnormally rapid combustion of carbohydrate ensues, and the blood sugar is held at a level below normal. Clinically this condition is known as hyperinsulinism or hypoglycemia. Dietary adjustment is essential in this condition also.

The Gonads

The gonads, sex glands (testes, ovaries, and their auxiliary structures) determine and control sex characteristics. To a slight extent they also influence the metabolic rate. As sexual activity slows down, so does the metabolic rate. Here again, overactivity and underactivity of the glands result in definite body changes. The sex hormones are being actively studied today, and far-reaching results may yet be attributed to them.

Abnormalities in weight are all too frequently blamed on glandular disturbance. See discussion of weight control. Probably in 8 or 10 per cent of the cases of obesity this may be true. It is interesting that in such cases the specificity of the fat deposits is typical of the gland involved.

As might be expected, since all hormones are blood-borne, their influence is widespread, and abnormalities in any gland can produce abnormalities in other glands until complicated clinical conditions and metabolic dysfunction may result. Wiggers, in discussing the interplay of the hormones of the endocrine organs, writes: "No single hormone or endocrine gland acts wholly by itself at any time; the effects are always produced through an interplay of several. . . . This interplay of the endocrine ensemble controls to a significant extent (a) metabolism, (b) growth and development, (c) sex functions and reproduction. Consequently, it proves didactically expedient to orient oneself with the general ways in which these interacting hormones modify these functions."

Review Questions

What are the endocrines?
Name them and state the function of each.
What is a hormone?
What is the cause of simple goiter? Hypothyroidism? Hyperthyroidism?
What three conditions may result from pituitary dysfunction?
What two secretions does the pancreas produce?
What functions have they?

CHAPTER X

THE VITAMINS AND VITAMIN DEFICIENCIES

Mankind has long known that certain diseases could be cured by specific foods. As mentioned earlier, centuries ago Hippocrates (500 B.C.), the Father of Medicine, prescribed the liver of the ox dipped in honey as a cure for night blindness. Three centuries ago Cartier described an outbreak of sickness (later known to be scurvy) cured by the "juice and sappe of the leaves of a certain tree." Two hundred years ago Lind proved that the inclusion of a "lime" each day in the diet of the sailors in the English navy prevented the terrific death toll of scurvy. Fifty years ago Takaki found that the beriberi afflicting the Japanese sailors could be cured by adding meat, vegetables, and milk to the polished rice diet then in use.

Magendie (1783-1855) first described an experimentally-produced disease by showing that guinea pigs could not survive if fed on a single foodstuff, and that on a mixture of foods health could be maintained. He wrote, "Variety in the diet is an important aid to health." Oliver Wendell Holmes expressed this thought in the *Mind's Diet*—

> "No life worth naming ever comes to good
> If always nourished on the selfsame food;
> The creeping mite may live so if he please,
> And feed on Stilton till he turns to cheese,
> But Carl Magendie proves beyond a doubt,
> If mammals try it, that their eyes drop out."

The last line refers to the true vitamin A deficiency which Magendie produced and described.

Lunin in 1881 fed mice on mixtures of artificial foodstuffs and found that for life "a natural food such as milk" must always be included.

Pekelharing (1905) likewise concluded that milk contained an unknown substance of paramount importance to nutrition.

In 1912 Hopkins proved beyond doubt that synthetic diets were not adequate for life. So clearly did he summarize his data

and the data of others, that he is credited with being the first to demonstrate conclusively the existence of a vitamin.

In 1912 Funk suggested that the name "vitamine" be given to these hitherto unnamed substances because he thought they were vital amines. This theory has since been disproved and the final *e* has been dropped from the term. It has been shown that vitamins represent a variety of chemical substances, their only common characteristic being that they function in minute traces and, if absent from a diet, specific deficiency diseases ensue. In the strict sense of the term a deficiency disease may arise from the lack of any dietary essential, protein, mineral, fat, vitamins, or other constituents. However, in popular usage, the term has come to be more or less specific for the conditions developing as the result of vitamin lacks. If a vitamin is completely lacking, a condition of avitaminosis results; if the deficiency is in amount, the condition is of hypovitaminosis. Subclinical deficiencies (hypovitaminoses) exist and are responsible for some forms of the vague ill health which prevail today.

Vitamins were originally named according to the letters of the alphabet and grouped under the two headings fat-soluble and water-soluble vitamins, but as their chemical structures are becoming known these letters are being replaced by correct chemical designations which indicate their widely varying chemical structure.

Certain definite vitamin deficiency diseases are well recognized: xerophthalmia (A), beriberi (B_1), scurvy (C), pellagra (nicotinic acid) and rickets (D), sterility in certain animals (E), bleeding due to lack of clotting (K), and other less specific conditions. All respond with rapidity to vitamin therapy.

In general, the well-balanced diet which includes milk, egg, meat, cereal, fruit, vegetable and animal fat, adequately supplies all the necessary vitamins. At times the need is increased, as in pregnancy, lactation, convalescence, and when the metabolic rate is elevated as in fevers and hyperthyroidism. At other times the increased need arises from faulty absorption of fat-soluble vitamins A, D, E, and K, due to inability to absorb fat normally. There may be increased need, faulty absorption, or destruction as in cases of gastrointestinal tract disturbances, or a "constitutional inefficiency" may be present. When such conditions exist, the vitamin in-

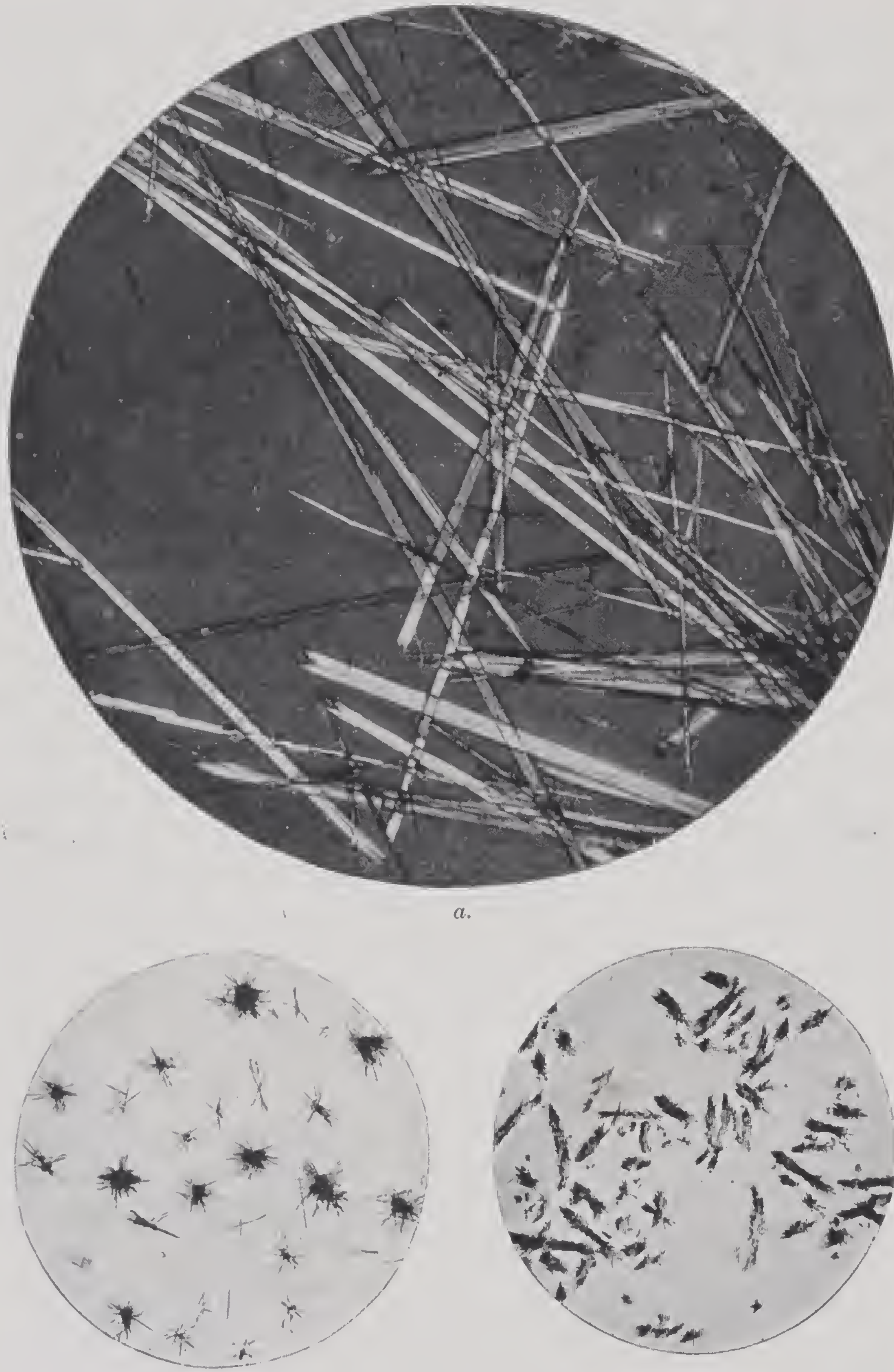
take must be adjusted carefully or commercial vitamin products must be employed. (See page 434.)

The present widespread use of commercial vitamin products and self-medication with them have assumed alarming proportions. Unfortunately, their sales constitute one of the most important items on the drug list. Too many of them have not been prescribed by a physician. These commercial vitamins, it must be remembered, are drugs and should be considered as such.

Vitamin research is an active field and has progressed to the point that it is possible not only to isolate pure vitamins from food products, but to synthesize them as well. The vitamin is no longer a vague, elusive something. It is a definite entity. The synthesis of vitamins B_1 (thiamine), B_2 (riboflavin), B_6 (pyridoxine), nicotinic acid, pantothenic acid, choline, para-aminobenzoic acid, folic acid, B_{12}, and biotin (members of the vitamin B complex), of C, D, and K, has been accomplished.

Vitamins were discovered through animal experimentation. Synthetic diets containing various food combinations fed to experimental animals made apparent one deficiency after another. Chemists kept pace with the research worker and rapidly isolated the vitamin, determined its chemical structure, and then synthesized the factor involved. Once the chemical structure is determined, methods for chemical detection are found, and the assay of various foods to determine their vitamin content becomes possible. It is also possible to determine the amount of vitamin in the blood, urine, spinal fluids, and tissues as a means of measuring the body tissue saturation point for various vitamins. Human studies involving these latter determinations have yielded approximate standards for calculating the dietary intake. If, for example, on a generous intake of a specific vitamin, a nearly constant amount is retained by the body each day, as evidenced by the difference between intake and excreted amounts, one may reasonably assume that amount to be the daily utilization or requirement.

The earlier vitamin studies were concerned with deficiency diseases and curative measures. More recently, however, attention has turned to the specific function of the vitamins—their physiological action in the body and the possible interrelationship of enzymes, hormones, and vitamins. As a result, data regarding the exact mechanism of vitamin activity are accumulating.



a.

b. *c.*

Fig. 36.—The crystalline vitamins (collected from various sources). *a*, The yellow crystals of vitamin A; *b*, thiamine chloride (B_1); *c*, riboflavin (B_2). (*a*, From *Have You Had Your Vitamins?* by Harry N. Holmes, copyright, 1938, and reproduced by permission of Farrar and Rinehart, Inc., Publishers; *b* and *c*, courtesy of Abbott Laboratories, North Chicago.)

With the availability of the crystalline products, progress has been made in the clinical application of vitamin therapy and methods for detection of deficiencies are becoming more exact. Dr. Jollifee has stated that "Nutritional inadequacy starts the instant that adequate amounts of any essential nutrient fail to reach the internal environment." He lists the stages of progressive deficiency as: (1) tissue depletion; (2) biochemical "lesions"; (3) altered function, and (4) anatomical lesions. They are clinically recognized, however, in reverse order.

The ability to determine vitamin values chemically has made many detailed studies possible which would not have been possible by the older methods of bio-assay (animal feeding experimentation). Formerly the vitamin assay of any substance required weeks of laborious animal feeding work. Today these same values for most of the vitamins can be obtained within a matter of hours.

The potency of vitamins is expressed in several ways (see Table 19).

TABLE 19

U.S.P. units— United States Pharmacopeia units set up by the Druggists' Association.

I.U.— International units, established by the Committee on Health of the League of Nations.

These two units are usually the same.

As grams (1/28 oz.), milligrams (1/1,000 gm.), and as micrograms (1/1,000 mg.) or gamma, a Greek letter sometimes used to designate the microgram.

As Sherman, Dam, Jukes-Lepkovsky, etc., units, units employing the name of the worker who first attempted to determine the quantitative presence.

Transposed into international units we have:

I.U. of vitamin B_1—2 Sherman units

These are, however, now better expressed on a milligram basis:

300 or 333 I.U. = 1 mg. of vitamin B_1
1 I.U. of B_1 = 3.3 gamma (0.0033 mg.)
20 I.U. = 1 mg. of vitamin C
1 I.U. of vitamin A = 0.6 microgram carotene
1 I.U. of vitamin A = 0.3 microgram pure A
1 I.U. of vitamin D = 0.025 microgram calciferol
400 Sherman-Bourquin units B_2 = 1 mg.
1 Sherman-Bourquin unit B_2 = approx. 2.5 gamma (0.0025 mg.)

Specific unitage will be indicated under the individual vitamins as each is discussed.

There is no international unit for riboflavin (vitamin B_2), and the potency expression is still based on the Sherman-Bourquin unit of 400 units per milligram when the microgram basis is not used. There is no international unit for niacin, pyridoxine, pantothenic acid, biotin, choline, or vitamins K and E. Potencies of the synthetic products are expressed directly on a milligram basis.

Vitamin A

Until 1913 it was believed that all fats had similar nutritive value. In 1913, however, McCollum and Davis, and Osborne and Mendel, demonstrated independently that certain fats had, in addition to calories, some factor necessary in the prevention of an eye disorder occurring in rats. Other fats did not have this protective ingredient. Further, rats could be stunted in growth and misshapen when certain fats were withheld. Cod-liver oil was found to be an extremely potent protective oil. Animal fats in general were protective; the vegetable fats were not. To the factor which was responsible for the protective action the name vitamin A was given.

In 1922 McCollum showed that vitamin A was actually two vitamins, one protective against eye disorders (antiophthalmic or antixerophthalmic), the other protective against bone abnormalities (antirachitic). The first fraction retained the designation vitamin A, and the second became known as vitamin D. McCollum discovered this duality by recognizing that cod-liver oil, which cured the dryness of the eye and rickets before the oil was treated with hot air, ceased to protect against xerophthalmia but continued to cure rickets after the treatment with the stream of hot air. He also realized that certain foods were protective against xerophthalmia and not against rickets, and the reverse. Mellanby in England showed essentially the same results, and hence, since 1923 the antirachitic fraction has been known as vitamin D.

Animals and human beings deprived of adequate vitamin A for a matter of weeks begin to show eye changes and impaired vision. At first there is inability to make light-dark adaptation with the sudden change from dark to light, a condition which is commonly called night blindness. The cause is lack of adequate vitamin A in

the retina.* The degree of vitamin lack can be measured by a machine known as a biophotometer. As the deficiency becomes more marked, eye changes increase. Concurrent with eye changes is a cessation of growth, a condition which has resulted in vitamin A being called a growth-promoting vitamin, which it is. The alteration of growth rate is due to the fact that vitamin A is an essential stimulus for cell formation. This action suggests the value of high vitamin intake in wound healing.

Fig. 37.—Xerophthalmia. The child is suffering from severe xerophthalmia due to a diet consisting largely of skim milk and cereals. At the time this picture was taken (1917) there were many such cases in Denmark due to the war ration. (Photograph of a baby from the practice of Dr. C. E. Block of Copenhagen.)

*In April, 1949, Dr. Wald reported that niacin is an essential factor in the mechanism which prevents the occurrence of night blindness.

A deficiency of any vitamin results in a slowing up of the growth rate. *Animals grow normally, have good muscular development, well-formed teeth and bones, bright clear eyes, and sleek soft hair only when the diet is adequate in all respects.*

In extreme deficiency, skin changes as illustrated in Fig. 38 may result. The skin becomes dry, normal sweat gland actually is absent, the skin is inelastic, is dull gray in color, and on scratching produces a white powdery desquamation. Cases reported are said to respond to high vitamin therapy in a few weeks. A relationship between hair loss and brittleness of fingernails and vitamin A intake has been suggested.

Severe vitamin A deficiencies are rare today, but mild deficiency is fairly prevalent. Inadequate intake of animal fat and the highly colored vegetables, or faulty fat absorption will result in such deficiency. Changes in the epithelial tissues are apparent in the eye, and also take place in the genitourinary tract and the respiratory system. Predisposition to infection results from the lowered resistance of the altered tissues. It does not follow, however, that one can increase resistance by attempting to overstock the body with vitamin A. This vitamin is anti-infective only when added intake raises a suboptimal level to a normal one. Vitamin A is also necessary for normal reproduction and for lactation in rats.

Fortunately, vitamin A can be stored for long periods of time in the body tissues. This is not true of all vitamins. Approximately nine-tenths of the stored material is in the liver.

In 1919 Steenbock suggested that there was some association between the yellow pigment in foods and vitamin A. In 1931 Moore and Alcott, and McCann, proved that this colored pigment, called carotene from carrots, the first known source, could be converted into vitamin A in the animal body. It is a precursor or mother substance of vitamin A, and is called provitamin A.

Vitamin A exists in two forms—as A_1 found in livers of salt-water fish and as A_2 in the livers of fresh-water fish. Vitamin A as such does not occur in the vegetable kingdom. It exists rather as the precursor or mother substance—the carotenes or carotenoids. Carotene is converted into vitamin A in the animal body. Conversion must take place before the vitamin is physiologically available to the animal. As might be expected in this reaction, loss occurs. Actually the "vitamin" value of carotene is but approxi-

mately one-half that of vitamin A. When data for vitamin content is expressed as carotene, this fact must be kept in mind.

Vitamin A is fat soluble, stable to heat, acids, and alkalis but is destroyed by light and is sensitive to oxidation especially in the presence of rancid fat. Recently vitamin E has been used to prevent the oxidation of vitamin A since vitamin E has been found to have anti-oxidant properties.

Fig. 38.—Cutaneous lesions in vitamin A deficiency, showing generalized xeroderma and follicular hyperkeratosis in a Chinese patient with xerophthalmia before halibut-liver oil therapy had been given. (Courtesy of Dr. Chester N. Frazier, from Sutton and Sutton: *An Introduction to Dermatology.*)

Vitamin A and carotene are abundantly supplied by cream, butter, milk, highly colored fruits, vegetables, liver, egg yolk, and salmon. A diet containing a pint of milk, a serving of butter, a

FOODS AS SOURCES OF

VITAMIN A

Green, leafy and yellow vegetables are outstanding sources. Dairy products, eggs and liver (and fish liver oils) are the important animal sources. Vitamin A is well conserved in cooking . . . .

CONTRIBUTION OF SELECTED SERVINGS OF A FEW FOODS AS PERCENTAGES OF ADULT MALE ALLOWANCE (5000 INTERNATIONAL UNITS (I.U.))

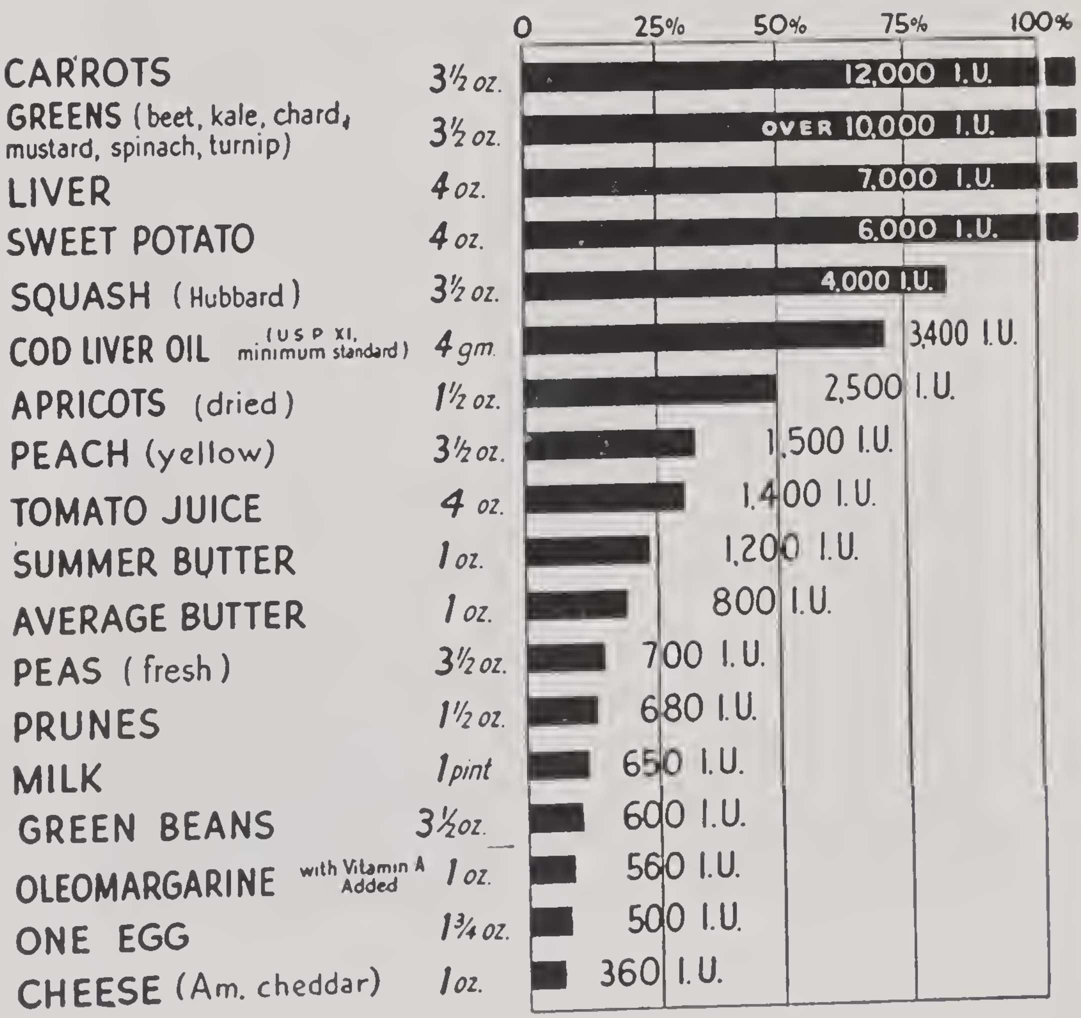


Fig. 39.—This and the following tables were prepared by a joint Committee of the Council on Foods and Nutrition of the American Medical Association and the Food and Nutrition Board of the National Research Council. They are reproduced by permission.

leafy or colored vegetable, and fruit in addition to a protein such as cheese, egg, liver, or dark-colored fish, meets the vitamin A requirement of the normal individual. The requirement is probably between 5,000 and 8,000 units daily.

TABLE 20

RECOMMENDED DAILY ALLOWANCES FOR VITAMIN A
(Food and Nutrition Board, National Research Council, Sept., 1948)

	I.U.
Man (70 kg.)	5,000
Woman (56 kg.)	5,000
During latter half of pregnancy	6,000
During lactation	8,000
Children up to 12 years	
Under 1 year	1,500
1-3 years	2,000
4-6 years	2,500
7-9 years	3,500
10-12 years	4,500
Children over 12 years	
Girls 13-20 years	5,000
Boys 13-15 years	5,000
16-20 years	6,000

Vitamin B or the B Complex

The single, water-soluble, antineuritic, antiberiberi vitamin B no longer exists. Today we know it is a group of vitamins. The water-soluble vitamin B described by McCollum and Davis in 1915 as necessary for health and growth, in collaboration with fat-soluble vitamin A, has undergone many changes. In 1926 it was found to be made up of two fractions (by Smith and Hendrick), the heat-labile (destroyable by heat) fraction called vitamin B_1 (antineuritic), and the heat-stable fraction called vitamin B_2 or G, or the PP factor; the latter designation because Goldberger found it contained the pellagra-preventing factor. Experimental studies with this second fraction (vitamin B_2) have since shown it to be composed of many substances, and not merely a single entity as is vitamin B_1. Therefore, we speak of the vitamin B_2 complex and know that it can be divided into vitamins B_2 or riboflavin, nicotinic acid or niacin as it is now named, B_6 or pyridoxine, pantothenic acid, biotin, para-aminobenzoic acid, cho-

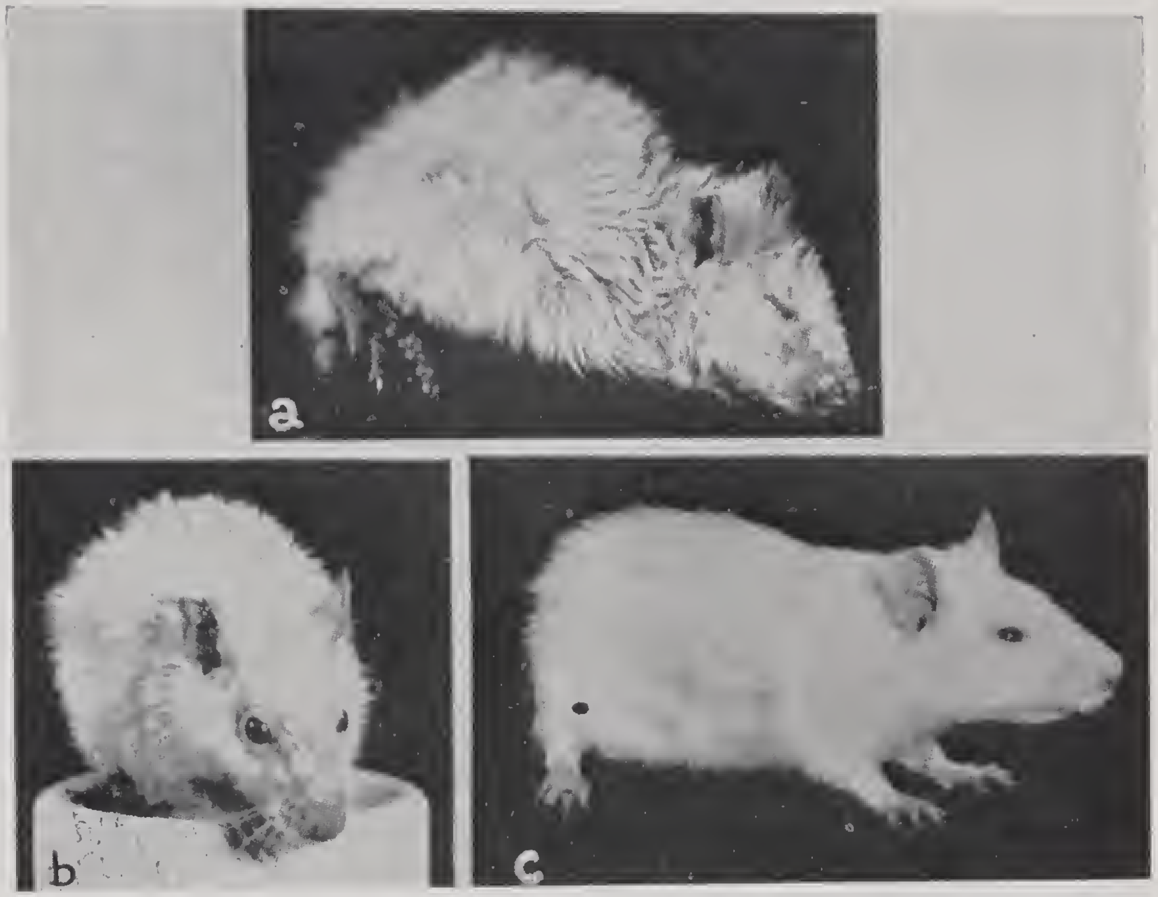


Fig. 40.—*a*, Rat maintained on vitamin B complex-free diet, supplemented with adequate crystalline vitamin B_1 and crystalline flavin (i.e., rat is deficient in vitamin B_6 and accessory growth factors). *b*, Two weeks after receiving Cerelexin (a vitamin B complex product). Attention is called to greatly improved dermatitis and restored growth of fur. *c*, After five weeks. Cerelexin has restored the animal to a completely healthy and normal condition. Observe the remarkable growth indicated on the chart. (Courtesy of the Upjohn Company, Kalamazoo, Mich.)

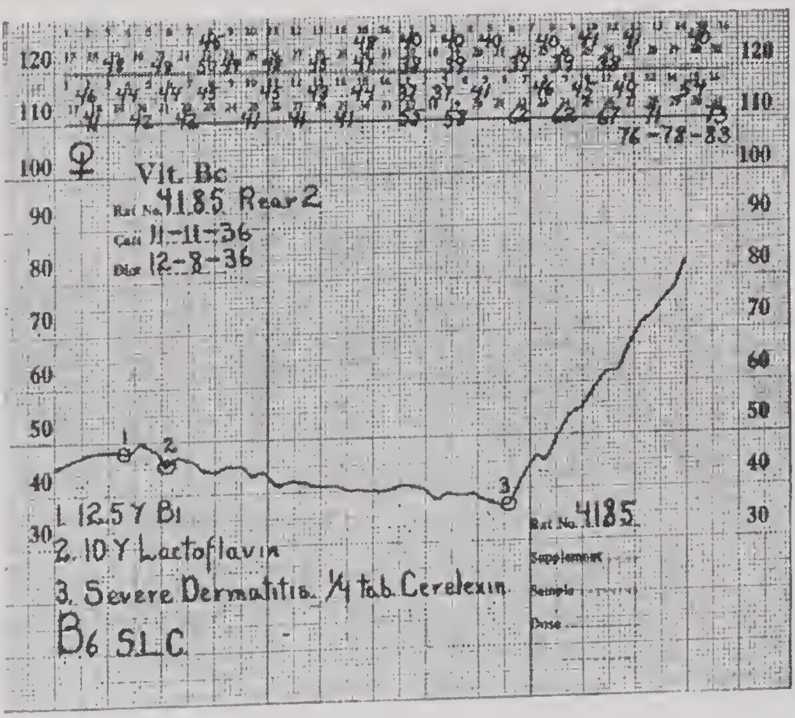


Fig. 41.—Growth chart of rat shown in Fig. 40. (Courtesy of the Upjohn Co., Kalamazoo, Mich.)

line, folic acid, B_{12}, and perhaps others. They will be discussed under their separate headings.

Vitamin B_1—Thiamine, $C_{12}H_{16}N_4OS$.—The disease beriberi has been recognized for many years. The high incidence of this disease led Takaki, an officer in the Japanese navy, to look for its cause. As only the Japanese navy was affected, he deduced that the disease was racial or due to their specific dietary, which was largely rice. He added meat, milk, and vegetables to the rice diet and great improvement resulted.

Eijkman also studied beriberi in the Java prisons about the same time, and in addition to his studies on human beings he observed that birds fed on polished rice developed a disease, the symptoms of which resembled those of beriberi. Birds fed on whole rice did not develop the disease. It was, therefore, obvious that rice polishings played some role in prevention of the disease.

Sufferers from beriberi complain of numbness in the legs, pain in the calf muscles, and exhaustion. Paralysis ultimately becomes marked, the individual has difficulty in breathing, and a specific type of heart trouble develops. Upon administration of vitamin B_1, recovery is rapid; if no therapy is given, the patient dies. A characteristic wasting in the ends of certain nerves can be demonstrated at autopsy, a peripheral neuritis, or peripheral neuratrophy.

Thiamine is essential for normal growth, appetite, tonicity of the gastrointestinal tract, and proper nerve function. Thiamine is also essential for the normal metabolism of carbohydrates. Without one of the salts of thiamine (cocarboxylase) the breakdown or oxidation of carbohydrate is upset; for this reason, the thiamine requirement of the body parallels the carbohydrate intake.

Thiamine is frequently referred to as the morale vitamin. Deficiency of thiamine induces a quarrelsome, "don't care" attitude, reduces efficiency and physical ability, and produces digestive disturbances, while vague symptoms of ill health accompany a feeling of nervousness.

Yeast, wheat germ, whole grain cereals, glandular meats, nuts, milk, green vegetables, and fruits are all sources of thiamine. Concentrates are prepared from yeast, wheat germ, rice polishings, or liver. See Fig. 44 for comparative values.

The unitage was originally the Sherman unit. Later the international unit, equal to 2 Sherman units, was established. There are approximately 300 I.U. in a milligram. Actually, if 1 I.U. is 3 micrograms of vitamin B, then there are 333 I.U. in a milligram. Three hundred is the value in general usage. To convert the values from units determined by bio-assay, which naturally

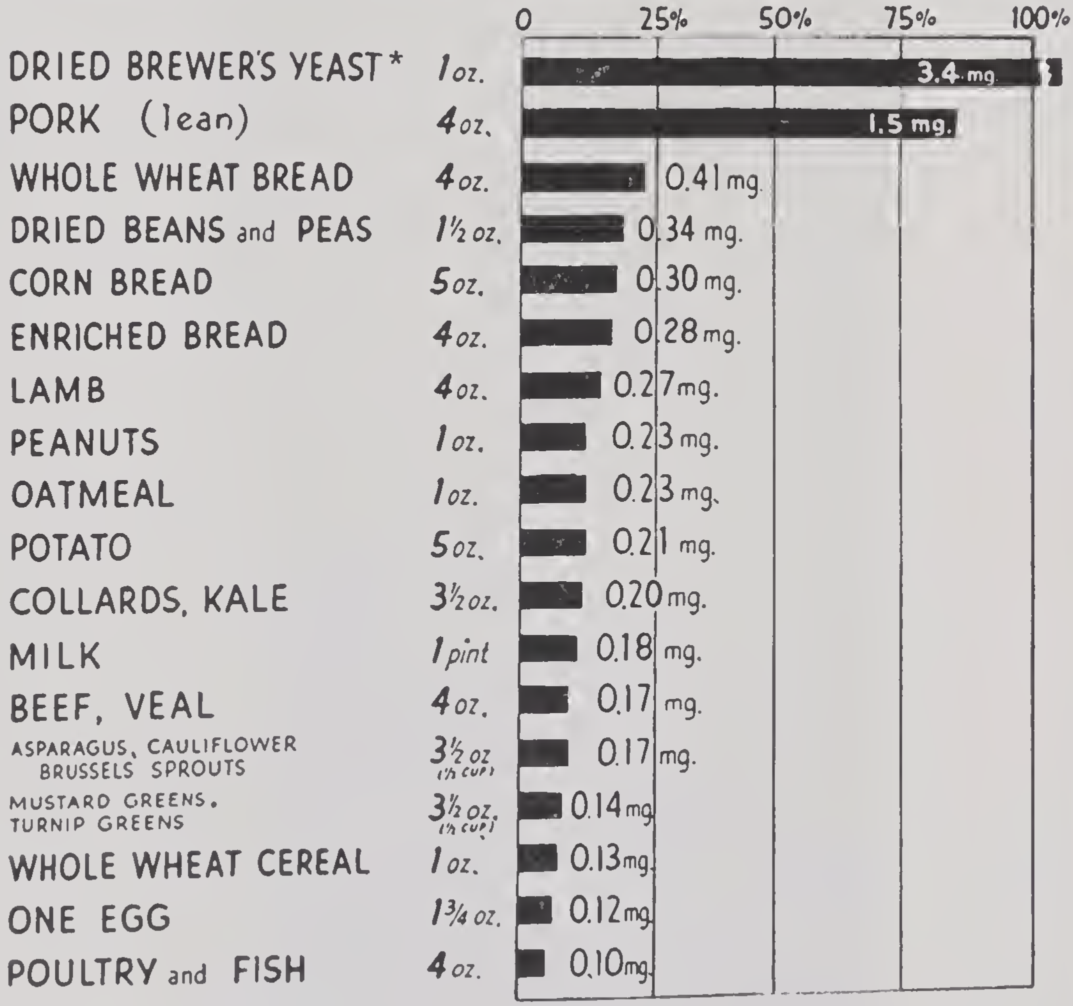
Fig. 42.—Cantonese slave girl showing the result of vitamin B_1 deficiency, the atrophy and degeneration typical of nutritional neuritis. In beriberi (outright B_1 deficiency) edema may or may not be present. "Dry" and "wet" forms exist. (From Talbot: *Clinical Pediatrics*, D. Appleton-Century Co., Inc.)

Fig. 43.—Lack of vitamin B. These rats are from the same litter. The one on the left had enough vitamin B_1. The other received none. Notice the result on general health and growth as well as on muscular control. (Courtesy of Wisconsin Alumni Research Foundation.)

FOODS AS SOURCES OF
THIAMINE
(VITAMIN B_1)

Except for pork, common foods supply only small amounts of thiamine, the best sources being nutritionally unimpaired cereals and meats; some thiamine may be lost in cooking, either through destruction by heat or extraction by water . . .

CONTRIBUTION OF SELECTED SERVINGS OF A FEW FOODS AS PERCENTAGES OF ADULT MALE ALLOWANCE (1.8 MILLIGRAMS) *



* U.S.P. XII Minimum Standard

*Since the preparation of this chart the recommended intake has been reduced to 1.5 mg.

Fig. 11.—This table was prepared by a joint Committee of the Council on Foods and Nutrition of the American Medical Association and the Food and Nutrition Board of the National Research Council.

varies slightly from laboratory to laboratory, depending on animal strain, environment, care, etc., to an accurate weight basis has not been entirely easy, and this accounts for discrepancies which appear in values given.

Since vitamin B is water soluble and heat labile, it follows that it can be destroyed or lost to varying degrees during cooking unless care is exercised. Its destruction is retarded by acid and hastened by alkali.

Unlike vitamin A, thiamine is not stored to any extent in the animal body; hence its regular inclusion in the diet is essential for prevention of deficiencies.

TABLE 21

RECOMMENDED DAILY ALLOWANCES FOR THIAMINE

(Food and Nutrition Board, National Research Council, Sept., 1948)

	Mg.
Man (70 kg.)	
Moderately active	1.5
Very active	2.0
Sedentary	1.2
Woman (56 kg.)	
Moderately active	1.2
Very active	1.5
Sedentary	1.1
During latter half of pregnancy	1.8
During lactation	2.3
Children up to 12 years	
Under 1 year	0.4
1-3 years	0.6
4-6 years	0.8
7-9 years	1.0
10-12 years	1.2
Children over 12 years	
Girls 13-15 years	1.3
16-20 years	1.2
Boys 13-15 years	1.5
16-20 years	1.8

Vitamin B_2—Riboflavin, $C_{17}H_{20}N_4O_6$.—A number of flavins (colored substances) occur in nature and all are identical. They are found in milk (lactoflavin), egg (ovoflavin), grass, liver, kidney, etc. The source names have been dropped in favor of the name riboflavin. This is a yellowish green fluorescent substance,

heat stable, but labile in alkali or upon exposure to light. Like the rest of the vitamin B complex, riboflavin is water soluble. Practical studies in cookery indicate that it is little affected by home stewing methods of meat cookery but there are appreciable losses when meats are roasted or fried. About 5 to 20 per cent loss occurs in the canning process. (See page 64.)

It is also known as vitamin G. Riboflavin is of interest because it provides another link between vitamins and enzymes. It, too, is involved in the metabolism and breakdown of carbohydrate.

Fig. 45.—Photograph showing effects of riboflavin deficiency in the diet. Above, rat that received a riboflavin-deficient diet. Below, rat that received a riboflavin-deficient diet supplemented with 90 micrograms of riboflavin weekly; in this animal there was no evidence of alopecia or cataract. The animals were photographed on the seventy-fifth day of experiment, at which time they weighed 35 and 150 gm., respectively. (From Day, Darby, and Langston: J. Nutrition 13: 392, 1937.)

A clear-cut human deficiency disease (ariboflavinosis) is not described, but a number of symptoms arise from lack of riboflavin. Lack of riboflavin may be associated with cataract. In conjunction with vitamin A, riboflavin probably is needed for the regeneration of the visual purple (rhodopsin) of the retina of the eye. Conjunctivitis, lacrimation, burning of the eyes, photophobia, and dimness of vision also occur.

A characteristic dermatitis about the nose and mouth of human beings also results from lack of this vitamin. The occurrence of comedones giving a "shark skin" appearance to the region of the nose and eyes is suggestive of riboflavin

deficiency. Lesions appear at the angles of the mouth (cheilosis), fine scaly desquamation in the nasolabial folds, in the vestibule of the nose, around the eyes and on the ears. The lips are reddened and denuded, and a glossitis appears.

Liver, kidney, milk, yeast, wheat germ, muscle meat, egg, and leafy green vegetables are the main sources of riboflavin. Other sources contribute little. See Fig. 47 for comparative values.

A. *B.*

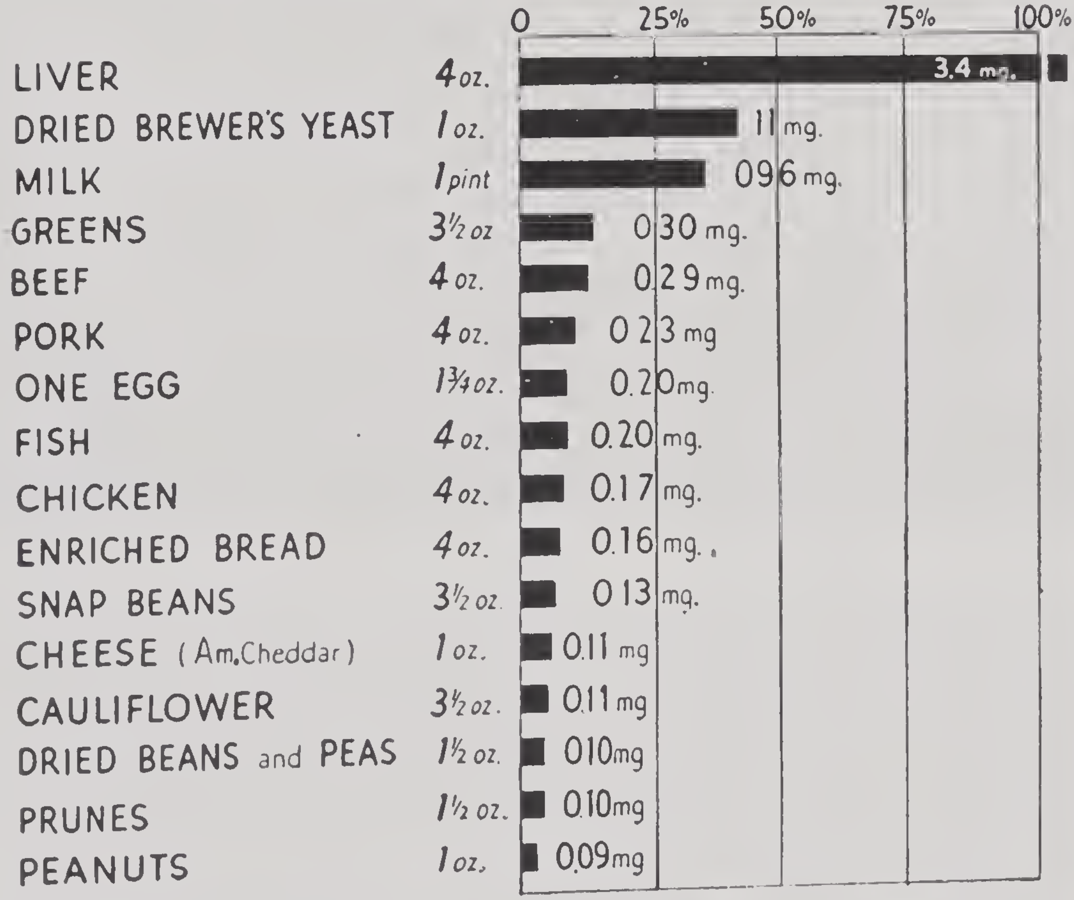
Fig. 46.—Cheilosis responds to treatment. *A*, Child 6 years old with typical lesions of ariboflavinosis, involving the upper and lower lips but not extending to the buccal mucosa. Other typical manifestations of riboflavin deficiency include photophobia, dimness of vision, and superficial keratitis. At right is the patient after a period of vitamin therapy. The lesions in this case were obviously the result of ariboflavinosis. Investigation indicated that the family of which the child was a member, subsisted principally on starchy foods; namely, macaroni and potato, with fruits and vegetables being eaten only occasionally. Meat was served once weekly and a quart of milk was apportioned daily among six. *B*, After treatment with riboflavin. (Reproduced from Therapeutic Notes, Parke, Davis & Co., through the courtesy of Dr. William P. Shields and the New England Journal of Medicine.)

Niacin (Nicotinic Acid) $C_6H_5O_2N$.—The background of our present knowledge of the vitamins always makes fascinating reading, and this is particularly true of nicotinic acid and is specific deficiency disease pellagra. Two hundred years ago this disease was de-

FOODS AS SOURCES OF RIBOFLAVIN (VITAMIN G)

Milk is the most important common source of riboflavin. This vitamin is not readily destroyed by heat but it may be lost by extraction in water during cooking and by prolonged exposure to light.

CONTRIBUTION OF SELECTED SERVINGS OF A FEW FOODS AS PERCENTAGES OF ADULT MALE ALLOWANCE (2.7 MILLIGRAMS) *



*The recommended allowance has been reduced to 2.0 mg. with the 1945 revision of the nutrients.

Fig. 17.—This table was prepared by a joint Committee of the Council on Foods and Nutrition of the American Medical Association and the Food and Nutrition Board of the National Research Council.

TABLE 22

RECOMMENDED DAILY ALLOWANCES FOR RIBOFLAVIN
(Food and Nutrition Board, National Research Council, Sept., 1948)

	Mg.
Man (70 kg.)	
Moderately active	2.0
Very active	2.6
Sedentary	1.6
Woman (56 kg.)	
Moderatively active	1.6
Very active	2.0
Sedentary	1.5
During latter half of pregnancy	2.5
During lactation	3.0
Children up to 12 years	
Under 1 year	0.6
1-3 years	0.9
4-6 years	1.2
7-9 years	1.5
10-12 years	1.8
Children over 12 years	
Girls 13-15 years	2.0
16-20 years	1.8
Boys 13-15 years	2.0
16-20 years	2.5

scribed and attributed to faulty diet. At one time it was thought to be due to a poison developing in corn (maize); another theory was that corn contains a photosensitizing substance similar to that found in buckwheat, which when acted upon by sunlight, produced characteristic skin changes in pellagra. Neither theory has any proof, except the coincidence of the pellagra prevalence in some corn-eating sections. The word *pellagra* means rough or inflamed skin. Spies suggests that pellagra should not be considered a disease of the skin, but a systemic disturbance.

To Goldberger (1913) is due the credit for establishing the pellagra as a deficiency disease which could be cured by the administration of brewer's yeast. Later he found that an acid extract of yeast contained the P.P. (pellagra-preventing) factor as did also certain other foods. Elvehjem (1937) later showed, by his experiments on dogs, that the nicotinic acid obtained from liver concentrates was curative for black tongue in dogs (a syndrome

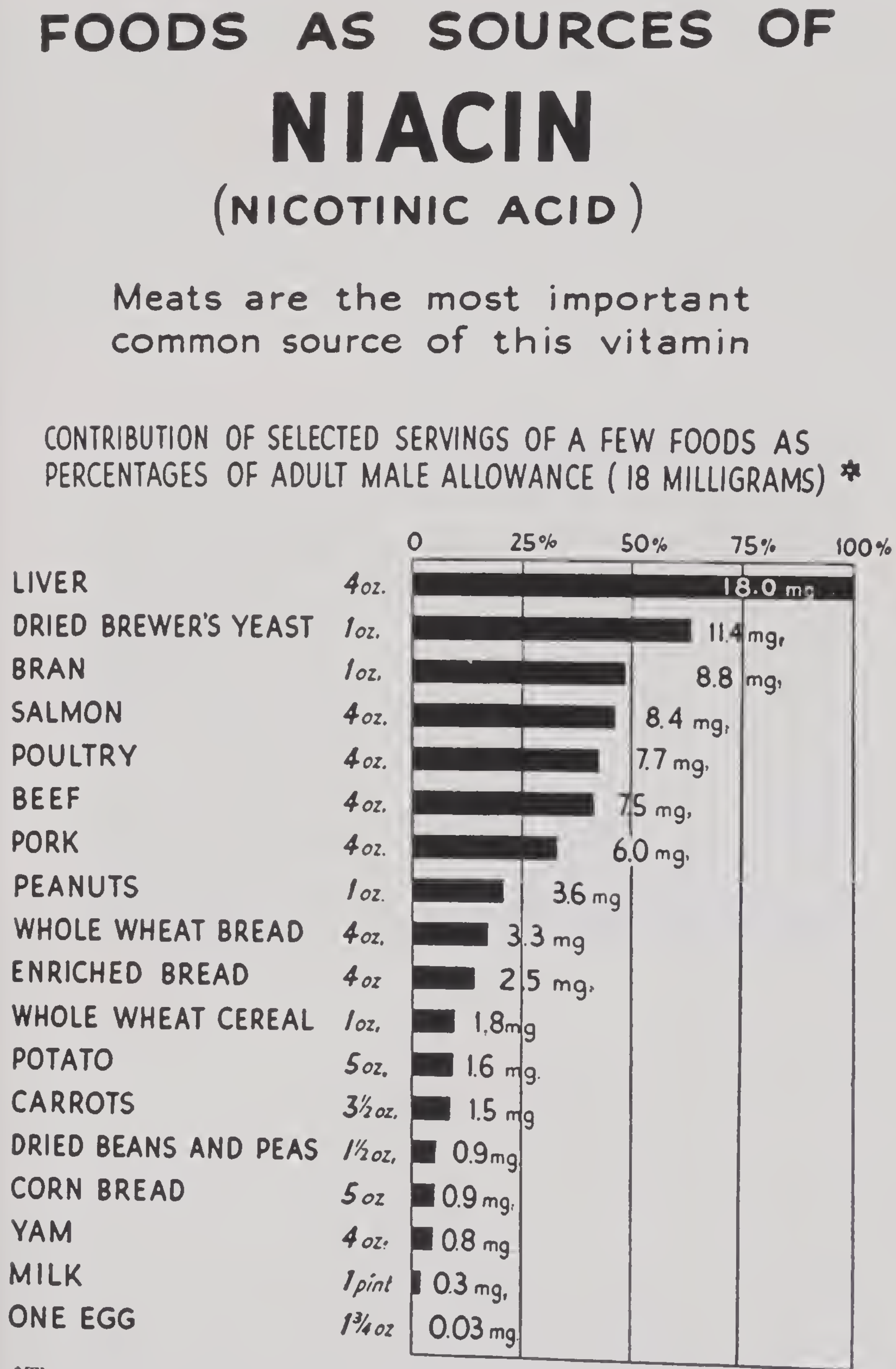
similar to pellagra in man) and from that Spies and his workers, and Smith and his associates, using nicotinic acid, obtained dramatic cures of pellagra. Recently, Spies and his co-workers have suggested that both vitamins B_2 and B_6 aid in making the cures permanent. Of further interest is the fact that nicotinic acid (nicotinamide is the preferred clinical form) is an important constituent of living cells and is concerned with fermentation, glycolysis, and respiration.

Nicotinic acid is a white, crystalline, water-soluble, heat-stable, alkali-labile powder, having the formula $C_6H_5O_2N$. The symptoms resulting from its lack (pellagra) are trembling of the head, burning pains in the mouth, vesicles on the lips, coated tongue, weakness, loss of appetite, gastrointestinal upsets, and typical skin lesions on the backs of the hands, the dorsal aspects of the feet, and around the neck and ankles.

Mild mental disturbances frequently are first to appear—confusion, dizziness, poor memory, and depression. Later the symptoms become more violent and hallucinations and delusions of persecution appear. The symptoms have been described as the 4 D's, dementia, diarrhea, dermatitis, and death.

Recent studies indicate that the entire picture is not yet clear. Perhaps the early linking of corn was not too far wrong. Corn does tend to increase the requirement for niacin—is this due to an antienzyme (an inhibiting substance) or does it alter bacterial synthesis of niacin? These are two new phases of vitamin need and function which will be discussed shortly. Again it may be due to another recent development indicating a vitamin-amino acid interplay. Corn has a low tryptophane content—and the addition of tryptophane to the diet does enhance the curative action of niacin in the presence of corn. Another thought is the general imbalance of the corn amino acids. At any rate, it opens up an entire new field of thought and research.

The pellagrin may well be helped by the high niacin containing foods because, in many instances, they are proteins of high value. Perhaps milk and eggs are effective for this latter reason even though their actual niacin content is low. It is a disease prevalent among the poor of the south whose basic diet is molasses, salt pork, and cornmeal. It is a serious economic problem.



*The recommended allowance has been dropped to 15 mg. daily since this chart was drawn.

Fig. 48.—This table was prepared by a joint Committee of the Council on Foods and Nutrition of the American Medical Association and the Food and Nutrition Board of the National Research Council.

Nicotinic acid is found in liver, yeast, milk, green leafy vegetables, salmon, tuna fish, peanuts, and to some extent lean meat and egg.

Nicotinic acid was prepared in pure chemical form as early as 1867 but was not recognized as the pellagra-preventing vitamin until 1937-1938. It is produced by oxidizing nicotine, during which process the toxic effect of the nicotine is destroyed and the vitamin is formed. It is the most stable member of the B complex.

TABLE 23

RECOMMENDED DAILY ALLOWANCES FOR NIACIN
(Food and Nutrition Board, National Research Council, Sept., 1948)

	Mg.
Man (70 kg.)	
Moderately active	15
Very active	20
Sedentary	12
Woman (56 kg.)	
Moderately active	12
Very active	15
Sedentary	11
During latter half of pregnancy	18
During lactation	20
Children up to 12 years	
Under 1 year	4
1-3 years	6
4-6 years	8
7-9 years	10
10-12 years	12
Children over 12 years	
Girls 13-15 years	13
16-20 years	12
Boys 13-15 years	15
16-20 years	18

Vitamin B_6—Pyridoxine, $C_8H_{11}O_3N$.—Existence of another fraction of the vitamin B_2 complex was established by György from his experimental work on rats during 1934 to 1936. In 1938 its isolation was reported by a number of workers and its synthesis was announced by Harris and Folkers in 1939. This substance, pyridoxine, was found to be effective in curing the "acrodynia-

like" dermatitis (florid dermatitis) in rats. Rats also appear to utilize their food more effectively where their intake of vitamin B_6 is adequate.

Specific human deficiency has not been established, but this vitamin seems to be essential for the final cure of some pellagrins and in clearing up some vague dermatoses. Beneficial results are also reported on its use in Parkinson's diseases, muscular changes and acne; negative results are likewise reported. Because of a sedative effect on human beings it has been used with some success in the nausea and vomiting of pregnancy.

Fig. 49.—Vitamin B_6 deficiency. (Courtesy of the late Dr. D. F. Robertson and the Merck Institute of Therapeutic Research.)

It has been suggested that pyridoxine or an associated form is concerned with the utilization of the unsaturated fatty acids—and the amino acid tyrosine.

According to Spies, the deficiency symptoms are extreme nervousness, irritability, abdominal pain, weakness, and difficulty in walking. Pyridoxine presumably is essential for hemoglobin formation although just how is not known.

Pyridoxine is a white crystalline powder, water soluble, heat stable, but destroyed by light. It is used clinically in the form of the hydrochloride. There is no suggestion as to requirement other than that it may be found to be similar to that for thiamine, namely, about 1.5 to 2 mg. daily. With adequate intake of the

potent whole grain cereals, legumes, seeds, and seed oils (corn, cottonseed), liver, kidney, and cane molasses, body requirements are undoubtedly met. Fish-liver oils are good sources, meats fair, and fruits and vegetables poor sources.

TABLE 24

PYRIDOXINE CONTENT OF FOODS*

	MG. PER 100 GM.
Yeast, brewers'	2.47
Yeast, Fleischmann's	3.95
Yeast extract	1.03
Wheat germ	1.03
Skim milk powder	0.38
Whole milk	1.25
Quaker rolled oats	0.25
Split peas	0.40
Leg of lamb	0.45
Beef liver	0.81
Liver powder (Wilson)	1.45
Nitab (rice-bran concentrate)	5.17

*These figures are taken from unpublished assays provided by Dr. C. A. Elvehjem, and reproduced from *Nutritional and Vitamin Therapy in General Practice,* by Edgar S. Gordon, with permission of The Year Book Publishers.

Pantothenic acid, $C_9H_{17}NO_5$, formerly known as "filtrate factor," was originally discovered as a "yeast growth factor." Now it is known also to be essential for animal well-being. Among the effects attributed to deficiency of pantothenic acid in animals are: emaciation, loss of and graying of hair, ulcers in the intestinal tract, adrenal, kidney and cardiac damage, tissue dehydration, and nerve degeneration, which results in a "goose step" gait. In fact, every tissue in the body seems to be affected by pantothenic acid deficiency. The word itself means "everywhere."

Human deficiencies are not yet clearly pictured. It is probable, however, that pantothenic acid is essential for human nutrition and that in some way its action is associated with riboflavin. The possibility of a relationship between human adrenal insufficiency and pantothenic acid deficiency is worth further study, as is its role in maintaining the integrity of nervous tissue.

Pantothenic acid is fairly stable to moist heat, especially at a neutral pH, but it is destroyed by prolonged dry heat. Studies as to loss during cooking are meager; however, the loss is probably of similar magnitude to that of thiamine since its solubility and stability are similar.

Liver is one of the richest natural sources. Meat, cereals, yeast, egg yolk, peanuts, and milk are good sources. In the process of milling grains into flour, only about one-half of the pantothenic acid is lost, contrary to the losses of other members of the B group.

TABLE 25

DISTRIBUTION OF PANTOTHENIC ACID IN FRESH FOODS IN MICROGRAMS PER GRAM

Liver	40
Egg yolk	63
Eggs	27
Broccoli	14
Peanut meal	53
Buttermilk, churned	4.6
Sweet potatoes	11
Lean beef	10
Beef liver	66
Pork liver	55
Beef heart	22
Pork loin	19
Leg of lamb	13
Skim milk	3.6
Squash	3
Canned salmon	7
Irish potatoes	6.5
Wheat bran	24
Canned pumpkin	4
Whole milk	2.8
Rice bran	22
Split peas	21
Tomatoes	1
Soy bean meal	14
Carrots	2
Rolled oats	11
Wheat	11
Barley	10
Spinach	1.2
Onion	1.2
Yellow corn	8
English walnuts	8
Oranges	0.7
Polished rice	4
Banana	0.7
Prunes	0.6
Raisins	0.6
Almonds	0.3

Reproduced from *Nuritional and Vitamin Therapy in General Practice*, by Edgar S. Gordon, with permission of The Year Book Publishers.

The requirement levels are not yet known, but one sees speculative suggestions that the daily requirement for the normal adult is from 5 to 10 mg. Elvehjem, however, computes the probable requirement may be around 5 mg. a day or the amount in 100 gm. of liver.

Choline, $C_5H_{15}O_2N$, has been known for many years to be a component part of the phospholipid lecithin, but not until about 1932 was its importance in nutrition demonstrated. At that time, it was shown by Best to be related to the mobilization of fatty acids in the body. With choline deficiency, liver fat rapidly accumulates. It is reported to be indispensable for lactation in adult rats and to prevent paralysis in suckling rats. The usual depression of growth rate occurs with its absence. It prevents hemorrhagic kidney degeneration in young rats and perosis (slipped tendon) in chicks and turkeys.

Fig. 50.—The rat on the left, whose hair was originally black, shows graying of the hair as the result of a diet deficient in the anti-gray hair factor. Its litter mate on the right received a normal diet. (Reproduced from *Therapeutic Notes*, courtesy of Parke, Davis & Co.)

Inasmuch as lecithin contains choline, meats, cereals, vegetables, and eggs become good sources of choline.

Para-aminobenzoic (p-aminobenzoic) acid, $C_7H_7NO_2$, also designated sometimes as PAB and PABA, a simple derivative of

benzoic acid, has been known to the chemists for years but not until 1941 was it shown to have vitamin-like activity. It was first recognized through its effect on bacterial growth. Positive and negative experimental evidence has been presented, indicating that graying of the fur of rats can be produced and cured by the para-aminobenzoic acid level of the diet. It has been reported to be involved in normal pregnancy and lactation in addition to the other B vitamins. The antagonistic action between para-aminobenzoic acid and the bactericidal effects of sulfanilamide (and the related drugs) is of current interest. The finding that para-aminobenzoic was capable of reversing or preventing the bactericidal action of the sulfonamides was the beginning of the antivitamin theory. It appears to be a competitive struggle between two structurally similar compounds for the same role. Clear-cut experimental data are lacking as to the role of para-aminobenzoic acid in human nutrition, that is, the requirement and distribution.

Biotin, $C_{10}H_{16}O_3N_2S$, has been recognized for some time as a dietary essential for micro-organisms but its importance to the animal body has only recently been recognized. Its formula was determined by du Vigneaud in 1942. It has also been known for many years that characteristic symptoms developed in rats fed on diets containing large amounts of raw egg white. These symptoms include dermatitis, especially involving the feet, spectacled eyes and a progressive alopecia, poor feathering (in chicks), slow growth, and a curious paralytic condition. Experimental studies revealed the fact that an albumin—avidin—active in raw egg white combines with the biotin of the egg white in such a manner as to render it inactive. A deficiency is thereby produced. The factor thus inactivated was formerly called vitamin H. Biotin and vitamin H are now known to be identical.

Human studies, of course, will be forthcoming as biotin has now become commercially available. One study was reported in which experimentally induced human biotin deficiency resulted in dry, peeling skin with a pronounced grayish pallor, muscle pains, lack of appetite, nausea, distress around the heart, and after the fifth week, the mild depression progressed to extreme lassitude, somnolence, and in two subjects out of the four, a mild state of panic.

All symptoms cleared within four days after biotin medication was begun. Liver, kidney, yeast, and egg yolk are the chief food sources.

Inositol, $C_6H_{12}O_6$, was first isolated from meat in 1850 but its role as a possible vitamin was not recognized until 1940. The suggestion that it is a member of the B group is strengthened by the fact that it, as the other members of the group, is universally present in living matter, although its distribution is more erratic and it appears in greater abundance. Inositol is a crystalline substance with a sweet taste. The phytin phosphorus of cereals has been found to be inositol-hexaphosphoric acid.

Fig. 51.—Biotin deficiency (egg white injury). This animal, aged 85 days, has received a diet containing 35% uncooked egg white since the age of 21 days and exhibits typical, acute, exfoliative, desquamative (seborrheic) dermatitis, accompanied by loss of hair. The dermatitis is particularly severe about the head, flanks, and forefeet. (Courtesy of Research Laboratories of the S. M. A. Corporation, Chagrin Falls, Ohio.)

A definite relationship appears to exist between inositol and pantothenic acid. Even when an adequate amount of inositol is present in the diet, it is not absorbed in the absence of pantothenic acid. Inositol has been shown to cure mouse alopecia and spectacle eyes, and to effect growth. The curative action and growth effect in some way appear related to the type and amount

of fat in the diet. Reports indicate it to be required by the lactating rat. When injected into dogs, it accelerates intestinal motility. Its significance in human nutrition is not known. However, it is believed to be a factor in stimulating gastrointestinal motility and to be involved in fat metabolism.

Spleen, heart, kidney, brain, thyroid, and testes are found to have an especially high content of inositol. Large amounts are found distributed in the plant kingdom in the form of phytine (the calcium-magnesium salt of inositol hexaphosphoric acid). No suggestion of requirement has been made.

Folic acid. The name folic acid has been given to one of the newer members of the B complex. Its synthesis in 1935 clarified reports on various postulated members of the B complex. There had been reports for a period of ten years on vitamins which were concerned with blood formation and growth in various animals. Vitamin M was essential for monkeys, factor U necessary for chicks, another deficiency condition in chicks was labeled as due to a deficiency of B_c. In bacteriologic studies need of a growth factor was found—a factor given the name of *L. casei* factor, one *S. lactis* R—and another potent factor which was called folic acid due to its abundance in leafy green plants. This factor was later found to occur in liver, kidney, yeast, and mushrooms. These independent studies were drawn together by the final isolation and synthesis of folic acid. This folic acid seemed to be the effective agent in each of the studies. So folic acid was accepted as the common vitamin.

Due to its relationship to experimental macrocytic anemia, it was immediately hailed as the curative factor. Much data are available; and even though as yet no definite statement can be made, it is assumed to be at least an important factor in the anemia picture. It is shown to be at least *partially* effective in five types of macrocytic anemia: pernicious anemia, nutritional macrocytic anemia, and the macrocytic anemia of sprue, pellagra, and pregnancy. The synthetic form is known as pteroylglutamic acid (PGA).

It is present in all animal tissues and is released by autolysis, a fact which suggests that it has functional activity.

B_{12} as an entity is less than a year old. It is the youngest officially recognized member of the B group. It was isolated

by painstaking fractionation of liver in an effort to find what fraction of liver was responsible for its antipernicious anemic action. The amount of liver needed to control a patient with pernicious anemia was roughly 400 gm. daily—nearly one pound. The extract was so concentrated that less than 1 mg. proved to be this liver equivalent. This vitamin (B_{12}) in all probability will prove to be the most important single factor in the treatment of pernicious anemia. Clinical reports are encouraging although some still contend that a combination of folic, B_{12}, and crude liver gives even better results. Data will continue to accumulate now that the crystalline vitamin is available.

If adequate intake of the better-known factors of the B group is obtained from natural sources, one can assume the less well-known ones will also be present. It is interesting that, in general, the distribution of the various members of the B complex can be correlated.

Vitamin C—Ascorbic Acid, $C_6H_8O_6$

For centuries scurvy, the deficiency disease resulting from lack of vitamin C, has been known to be due to a stale diet. Sailors on long sea voyages "fell sick and died" from a typical disease, apparently only because no fresh food was obtainable. In reading the history of scurvy it is all too evident that the knowledge obtained from empirical (experimental rather than scientific) observation was forgotten and rediscovered many times.

In the stories of the Crusades in the middle of the thirteenth century one finds described the spongy condition of the gums, which was so severe that "the barber surgeons were forced to cut away the dead flesh from the gums to enable the people to masticate their food." Other descriptions mentioned the prevalent tendency to great weakness and black spots on the legs. Long bones may be rarefied, sometimes fractured at the junction of the shaft and epiphysis; ribs may be swollen and sometimes fractured. In young children there is a typical apprehensive cry from fear of being touched, extreme irritability, and restlessness. Anemia is frequently present.

The first scientific study of scurvy was made in 1757 by James Lind, a surgeon in the English Navy. He took 12 men suffering with scurvy and to each he gave different medication. After 6

days, the pair receiving 2 oranges and 1 lemon daily had improved and one went back to active duty. The other was well enough to be appointed nurse to the other 10 who were still suffering. He thereby showed that citrus juice was the only effective cure. As a result of this report, lemons were regularly included in the diet of English sailors and scurvy was practically eliminated. The words "limer" and "limey" arose from this experiment.

Just before the beginning of this century (in 1883), Sir Thomas Barlow described the disease as it occurred in babies, and it became known as Barlow's disease. Babies fed too long on boiled milk and gruels were prone to develop this condition. Today orange juice added to the formula of a bottle-fed baby is a recognized procedure.

The most clearly established function of ascorbic acid probably is that of maintenance of intercellular substance. In fact, scurvy has been characterized as a condition in which defective intercellular materials are formed. With complete deprivation of vitamin C, it has been reported that certain skeletal tissues formed a fluid material, rather than their natural products, dentine or bone, and that the administration of the vitamin causes the liquid to solidify or jell. It has also been suggested that with a deficiency a breakdown reaction occurs which results in the abnormal condition. The exact mechanism of this action is still not proved, but at least it is definite that a defective mechanism does result and that the normal process is interfered with. This abnormality of intercellular material permits leakage of blood from the capillaries in the scorbutic individual, when pressure is applied.

Inasmuch as vitamin C is necessary for tissue respiration, as part of the oxidation-reduction system of the body, in the absence of the vitamin the body cells cease to function normally, and probably this contributes to the breakdown of, or failure to build, normal body structures. Failure of tissue to heal in the absence or with a deficiency of ascorbic acid has resulted in its widespread and successful use in surgery.

It is also suggested that vitamin C plays a role in combating and neutralizing the toxins of infectious diseases and that it may be concerned in the formation of specific antibodies. Its role in the control of glandular secretion is also under consideration.

Complete absence of the vitamin, or its presence in only trace amounts in the diet, results in frank scurvy.

Subclinical deficiencies, those instances where the clinical symptoms are not sufficiently definite to suggest the disease immediately, but where the more sensitive tests for deficiency can prove its existence, are now recognized. When the vitamin C intake

Fig. 52.—Due to an increase in the fragility of the capillaries, rupture readily takes place on pressure either constant or abrupt. (From Harris, *The Vitamins,* Cambridge University Press.)

is below the requirement level, vague ill health may result, and there are a number of symptoms which appear either singly or in combinations. Inadequate intake or subclinical scurvy may be characterized by: loss of appetite, vitality and weight, irritability and apprehension, muscular weakness, joint pains and swelling,

loosening and decay of teeth, spongy gums, hemorrhage—cutaneous, intramuscular and joint—anemia, rarefaction of long bones, fracture at junction of shaft and epiphyses, gastrointestinal tract disturbances, and predisposition to infections and lesions.

Fig. 53.—Vitamin C is needed to prevent scurvy. The guinea pig is suffering with scurvy due to lack of vitamin C. This deficiency also affects the teeth and gums of human beings. (Courtesy of the Wisconsin Alumni Research Foundation.)

Fig. 54.—This guinea pig, a litter mate, has received a diet adequate in vitamin C.

Ascorbic acid, a white crystalline powder, readily oxidized and rendered inactive in alkaline solution, has the formula $C_6H_8O_6$. It was originally known as hexuronic acid. Later the term cevi-

tamic acid was given to the crystalline product used for clinical purposes. Now, however, both chemically and clinically it is called ascorbic acid.

It is abundantly supplied by citrus fruits (100 c.c. orange juice yields approximately 50 mg. of ascorbic acid).* Other fruits, including tomatoes, are good sources. All leafy green vegetables and sprouted seeds are excellent sources. The daily inclusion of a citrus fruit plus a salad assures an intake of around 75 mg., which is the probable daily adult optimum maintenance requirement. From 25 mg. for small children to 100 mg. at puberty is the probable need.

TABLE 26

RECOMMENDED DAILY ALLOWANCES FOR ASCORBIC ACID
(Food and Nutrition Board, National Research Council, Sept., 1948)

	Mg.
Man (70 kg.)	75
Woman (56 kg.)	70
During latter half of pregnancy	100
During lactation	150
Children up to 12 years	
Under 1 year	30
1-3 years	35
4-6 years	50
7-9 years	60
10-12 years	75
Children over 12 years	
Girls 13-20 years	80
Boys 13-15 years	90
16-20 years	100

Storage of food at room temperature results in marked vitamin loss. The protective action of the natural acid as occurs in citrus fruits and tomatoes results in excellent retention even in the canned products. The leafy salad vegetables and other fruits are not so protected. Maceration of tissues, as in the chopping of salad greens, also results in an accelerated loss—a point to keep in mind in holding chopped vegetables unduly long.

The precautions suggested under vitamin B_1 for the handling of water-soluble vitamins to prevent destruction or loss apply also

*Under current commercial processes both canned and frozen citrus fruit juices may be accepted as equivalent in vitamin C potency to the fresh fruit juice.

FOODS AS SOURCES OF ASCORBIC ACID (VITAMIN C)

In addition to citrus fruits and tomatoes many common fruits and vegetables supply significant amounts of ascorbic acid, especially if eaten raw. This vitamin is readily destroyed by heat and it is extracted by water.

CONTRIBUTION OF SELECTED SERVINGS OF A FEW FOODS AS PERCENTAGES OF ADULT MALE ALLOWANCE (75 MILLIGRAMS)

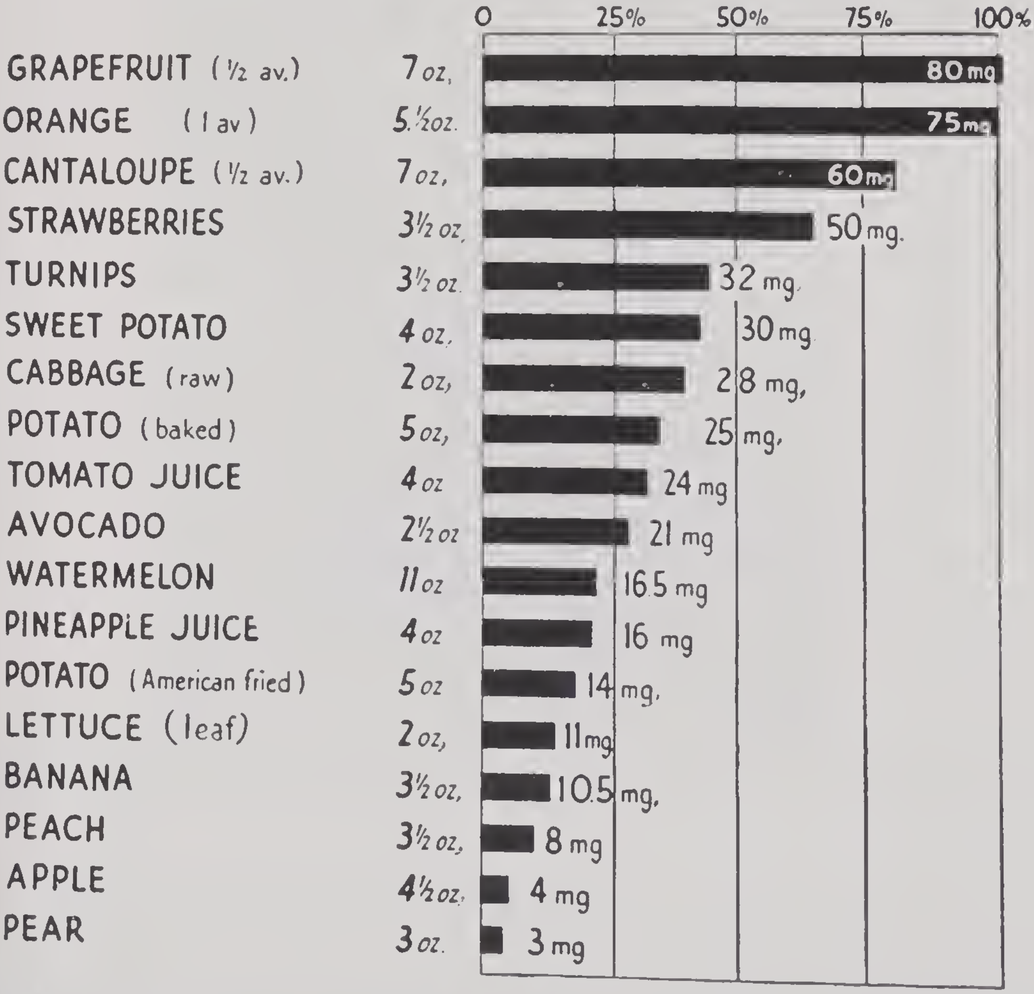


Fig. 55.—This table was prepared by a joint Committee of the Council on Foods and Nutrition of the American Medical Association and the Food and Nutrition Board of the National Research Council.

to vitamin C. Roughly one-half of the vitamin can be dissolved out by the cooking water. Indications for increased intake are suggested under the general discussion of vitamins.

See chart on quantitative relationships (Fig. 55).

Vitamin D—Calciferol

Like beriberi, scurvy, and xerophthalmia, the disease rickets has been known for centuries. In 1650 Francis Glisson wrote a classical discussion of the subject. In 1922 McCollum showed rickets could be cured or prevented by the addition of certain oils to the diet. The minerals calcium and phosphorus are also factors involved in the occurrence or prevention of rickets (see Minerals, Chapter XI. For normal bone-tooth formation calcium, phosphorus, and vitamin D must be present.

Fig. 56.—Rickets following a diet of 175 c.c. of whole milk, white bread *ad lib.*, and 10 c.c. of linseed oil per day. Time of experiment, five and one-half months. Increase in weight during period of experiment, 2,670 gm. (Courtesy of Controller of H. M. Stationery Office from Medical Research Council Report No. 167.)

In 1919 it was shown that light rays could heal rickets, the rays from the sun itself or the artificially produced ultraviolet ray. In 1924 it was demonstrated that food could be irradiated by the ultraviolet ray and thereby become capable of curing rickets. What power has the sunlight ray? The discovery was made that vegetable and animal tissues (body skin) contain a lipid fraction,

itself inactive, but which could be made active by the ultraviolet ray. Ergosterol in grain and a sterol in animal tissue are precursors of vitamin D, or provitamin D. This fact has led to the irradiation of cereals, milk, etc., and the use of sunlight, both natural and in the form of rays from sun lamps.

Fig. 57.—Rickets. Square head, frontal bosses, enlarged costochondral junctions ("rachitic rosary"), and Harrison's groove. (From Marriott: *Infant Nutrition*, The C. V. Mosby Company.)

In 1930 crystalline vitamin D was isolated from crude irradiation products of ergosterol and was given the name calciferol. It has a potency of 40,000 U.S.P. units per gram. It is now known that ten vitamins D (D_1, D_2, D_3, etc.) exist. They all have slightly different formulas and are not equally antirachitic. Calciferol, obtained from irradiation of ergosterol, is vitamin D_2

($C_{28}H_{43}OH$). Commercially, dissolved in oil, it is known as viosterol. From irradiated animal sterol vitamin D_3, 7-dehydrocholesterol ($C_{27}H_{43}OH$), is obtained. Commercially it is known as Delesterol when dissolved in oil.

Vitamin D is the only vitamin not abundantly supplied in food form. In regions where adequate sunlight exists and clothing is scanty enough to permit direct action of sunlight on the skin, little danger of rickets occurs. Ordinary window glass stops most of the ultraviolet rays and allows only light to pass through. In modern conditions of living, especially where sunlight is limited, some supplementation of food vitamin D is imperative. Cod-liver oil should be considered as food in the diet of all children from infancy through the period of structural growth.

Liver of all kinds, especially fish liver, egg yolk, milk fat, and salmon are the most potent food sources of vitamin D. Milks may

TABLE 27

RECOMMENDED DAILY ALLOWANCES FOR VITAMIN D
(Food and Nutrition Board, National Research Council, Sept., 1948)

	I.U.
Woman (56 kg.)	
During pregnancy and lactation	400
Infants and children through 20 years of age	400

TABLE 28

VITAMIN D CONTENT OF FOODS

FOODS	I. U. PER 100 GM.
Butter, average	80
Butter, cows on dry feed	40
Butter, cows on pasture	150
Liver, chicken	55
Liver, beef	45
Liver, calf	10
Liver, lamb	17
Liver, pig	44
Clams	5
Eggs	15
Egg white	0
Egg yolk	45
Milk, whole	2
Milk, average market	2
Milk, cows on dry feed	1
Milk, cows on pasture	4
Oysters	5

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be enriched by irradiation, by the feeding of irradiated yeast to the cows, or by direct addition of a vitamin D concentrate to the milk. Irradiated milk has a usual potency of 135 U.S.P. units per quart. Recently, however, it has been found that values as high as 400 units per quart may be obtained by irradiation. Reinforced or fortified milk contains 400 units per quart.

Vitamin E—Alpha-Tocopherol, $C_{29}H_{50}O_2$

As early as 1920 Mattill and Conklin found that rats reared on cows' milk were incapable of raising young, even though the milk, as they thought, was adequately supplemented to make an adequate diet. Two years later Evans and Bishop reported that for normal reproduction a definite dietary factor was necessary. This factor, first designated vitamin X and later changed to vitamin E, is now known to be alpha-tocopherol, an alcohol having the formula $C_{29}H_{50}O_2$. The name signifies its role—*tokos* meaning childbirth, *phero* meaning to bear, and *ol* meaning an alcohol. Actually four tocopherols exist, alpha, beta, gamma, and delta. These differ slightly chemically and in biological activity. The alpha is the most potent biologically.

Although sterility may result from a deficiency of any kind, vitamin E is specifically essential for normal reproduction in certain animals; hence its designation as the antisterility vitamin. How important it is for the human being is not entirely settled. Clear-cut experimental data to decide the matter are difficult to obtain.

Besides the effect on the reproductive system, degenerative changes in the nervous system take place when vitamin E is withheld. The neurologic disturbances are different from those due to lack of vitamins A and B_1, or nicotinic acid. A typical paralysis develops. In the final stages animals are unable to walk; they drag their hindquarters and support themselves on their front legs if forced to move from their peculiar lying position. The suggestion has been made that there may be a relationship between vitamin E and the hormones. Rats deprived of vitamin E exhibit marked hypoplasia of the thyroid gland. In chicks it seems to be necessary for normal permeability of capillary walls. On vitamin E-deficient diets exudation of large amounts of blood plasma from the capillaries appears under the skin.

Clinically vitamin E has been used experimentally in muscular dystrophies and in habitual abortion. The results are conflicting.

While the metabolic function of Vitamin E is not established, evidence indicates that it is a regulator of metabolic activities in the cell nucleus; it regulates oxidative processes as an antioxidant.

The vitamin is distributed in nature in the oils of seeds and grains, such as cotton, rice, or corn, wheat germ and wheat-germ oil. Leafy green vegetables, and to a lesser extent eggs and meat, are sources of the vitamin.

Fig. 58.—A 22-month-old rat showing paralysis due to vitamin E deficiency. (Courtesy of Dr. G. O. Burr, University of Minnesota, and Hawley and Maurer-Mast: *The Fundamentals of Nutrition*, Charles C Thomas Co.)

Deficiency is probably rare. The Rochester workers* have calculated the vitamin E intake in typical diets for health and disease and include that the average American appears to receive about 15 mg. tocopherols daily against a calculated requirement of 25 mg. They state: "one important fact emerges, namely,

*Hickman, K. C. D., and Harris, P. L.: Tocopherol Interrelationships. Advances in Enzymology 6: 469, 1946. Interscience Publishers, Inc.

We are indebted to Dr. Philip Harris of Distillation Products, Inc., Rochester, for the following table of food values:

TABLE 29

VITAMIN E CONTENT OF FOODS

	TOTAL TOCOPHEROLS MG./100 G. FRESH FOOD
VEGETABLES	
Beans, dried navy	3.6
Cabbage	0.11
Carrots	0.45
Celery	0.48
Lettuce, iceberg, 1	0.54
2	0.68
* 3	0.43
Onions	0.26
Peas, green	2.1
Potatoes, peeled	0.06
Potato peels	1.8
Tomatoes	0.36
Turnip greens	2.3
CEREALS	
Cornmeal, yellow	1.7
Oatmeal	2.1
Rice, brown	2.4
Rice, polished	0.57
Wheat products:	
Bread, white	0.23
Bread, whole wheat	1.3
Crackers, soda	3.7
Farina	1.6
Flour, white (80% extraction)	1.2
Flour, whole wheat	2.2
Spaghetti	1.2
MEAT, FISH, POULTRY, AND DAIRY PRODUCTS	
Bacon	0.53
*Beef, dehydrated	
Beefsteak	0.63
Lamb chops	0.77
Pork chops	0.71
Fish (haddock)	0.39
Chicken	0.25
Eggs (whole)	2.0
Butter	2.4
Cheese, American	1.0
Milk, fresh	0.12
Milk, evaporated	0.30
FRUITS	
Apples	0.74
Bananas	0.40
Grapefruit	0.26
Oranges	0.24

*Bioassayed.

TABLE 29—CONT'D

	TOTAL TOCOPHEROLS MG./100 G. FRESH FOOD
FATS AND OILS	
Cottonseed oil, refined	90
Corn oil, refined	87
Lard	2.7
*Margarine, clarified	54
Olive oil	6.9
Soybean oil, refined	140
MISCELLANEOUS	
Apple pie 1	0.20
2	2.2
3	0.29
Chocolate, unsweetened	11.1
Peanuts	9.3

*Bioassayed.

the important place that vegetable fat, exemplified by margarine, occupies as a source of vitamin E."

The needs during pregnancy are tentatively set at 50 mg. daily. Synthetic tocopherol (as the acetate) and "concentrates" obtained by distillation are now available. Expression of potency of these products is on a milligram basis.

Vitamin K—Menadione

Vitamin K, the coagulation (koagulation) or prothrombinogenic factor, is another vitamin belonging to the fat-soluble group.

It was discovered by Dam (a Dane) in 1929 while he was studying cholesterol metabolism in hens. He observed a peculiar hemorrhagic disease, characterized by a prolonged bleeding time, with some symptoms of scurvy. In 1935 this was shown to be a dietary deficiency disease. Later (in 1936) Dam and his co-workers found this hemorrhagic condition to be due to a decrease in blood prothrombin. The diet normally supplies adequate vitamin K, since it is found in most leafy green vegetables, hemp seed, soybean oil, rice bran, egg yolk, etc., and apparently is synthesized by bacterial action in the intestine. However, if for any reason fat metabolism is abnormal due to inability to digest fats, or to absorb them when bile is absent, or if there is marked liver damage, deficiency of vitamin K occurs (hypoprothrombinemia). Fatal hemorrhages have been known to occur in the newborn at about the third day of life, and experimental work, given impetus by the discovery of

vitamin K, has shown that these infants had a prolonged clotting time. It is now known that this prolonged clotting time can be restored to normal by a single dose of 1 mg. of the new synthetic vitamin K. This single dose will also carry the infant over the critical period. Hemorrhages due to hemophilia, however, are not corrected by this vitamin inasmuch as the prothrombin of the blood in this condition is not below normal.

Vitamin K is available commercially in two forms, in an oil prepared from alfalfa, and as a synthetic crystalline product, either oil-soluble or water-soluble. There are several vitamins or substances with vitamin K activity—K_1 ($C_{31}H_{46}O_2$), K_2 ($C_{41}H_{56}O$), and others. Potency of the synthetic product, which has been named menadione, is expressed on a milligram basis. For the natural product several units are used. The chick units, established on the basis of the effect of the vitamin on chicks, are named after Dam, Ansbacher, or Almquist.

Natural vitamin K is found in alfalfa, kale, spinach, dried carrot top, tomatoes, soybean oil, putrefied fish meal, bran, and casein.

Vitamin P

In 1936, Szent-Gyorgyi and his co-workers postulated the existence of a new vitamin in lemon peel which they called vitamin P, designating capillary permeability. Szent-Gyorgyi believed vitamin P to be citrin, a mixture of the flavone glucosides, hesperidin and eriodictyol. The reports of usage of this product have been contradictory. However, in 1942, hesperidin chalcone ($C_{22}H_{26}O_{12}$) was isolated from lemon peel. This substance is believed to be the pure form of Szent-Gyorgyi's vitamin P. Preliminary experiments with this material have shown that it does exert beneficial effect upon the state of the capillaries, decreasing the fragility and preventing localized hemorrhages.

Lemon is a rich source of this vitamin. A single lemon—juiced, the peel minced, covered with water, and boiled for 10 minutes in a glass container, and the strained liquid added to the lemon juice—has a yield of approximately 150 mg. of vitamin P.

Rutin

More recently, another flavone-derivative glucoside has been found in tobacco leaves and buckwheat. It is reported to have

physiological activity similar to vitamin P. It is available for clinical use and is under such investigation. The potential value of both of these vitamins is apparent, if the final evidence is conclusive, in the protection of the vascular system in conditions of high blood pressure.

Essential Fatty Acids

The unsaturated fatty acids which are necessary for normal nutrition can logically be discussed with the vitamins. While in general the body can synthesize fats from nonlipid substances (carbohydrates and fats), it seems to be incapable of building up certain specific fatty acids which within the last ten years are known to be essential. (See Chapter V, The Fats.)

Fig. 59.—These rats are litter mates. The one on the left received a diet containing 20 per cent lard; the one on the right received no fat. (Courtesy of Dr. George Burr, from Hawley and Maurer-Mast: *The Fundamentals of Nutrition*, Charles C Thomas Co.)

In 1929 Burr and Burr found that on a fat-free diet animals grew for a time, but the hair about the face and neck tended to drop out. Dandruff also developed. The skin became scaly, the tip of the tail appeared inflamed, swollen, scaled, and ridged, hemorrhagic spots became visible, kidney disorders developed, and the animals refused to mate.

The disease can be prevented or cured by the addition of any one of three unsaturated fatty acids: linolenic ($C_{18}H_{30}O_2$), linoleic ($C_{18}H_{32}O_2$), or arachidonic ($C_{20}H_{32}O_2$). These acids are contained in the seed oils: cottonseed, linseed, peanut, olive, wheat germ, and soybean; lard, egg yolk, and to a slight extent, butter. These same vegetable oils are ineffective in preventing vitamin A and D deficiencies, and, therefore, were formerly thought to be of caloric

value only; it now appears that they have specific value other than as fuel foods because they contain not only essential fatty acids but pantothenic acid in addition. For example, corn oil (Mazola) contains: oleic acid 48%, linoleic 38%, stearic 29%, palmitic 1.0%, myristic 1.7%, hexadecanoic 1.6%, arachidonic 0.4%, and lignoceric 0.2%. Linoleic acid constitutes varying amounts in other fats or oils; to name a few: 50% of soybean oil, 25% of peanut oil, 15 to 19% of egg yolk fat, 7% of olive oil, and 1 to 7% of lard.

The dermatitis which appears in lack of vitamin B_6 is similar to that produced by lack of the essential fatty acids, and it has been suggested that there is some relationship between these acids and the vitamin.

Miscellaneous Postulated Vitamins

Other vitamins for which there is as yet no definite proof, and which to date have no relation to human nutrition are suggested. It can be assumed that if the diet is well balanced, and the known vitamins are supplied, the possible obscure vitamins will likewise be present. It is because of the interrelation between the various known vitamins and the additional vitamins found from time to time in food products, that it is important to obtain our vitamins from natural sources, rather than in commercial form (synthetic vitamins). An exception to this rule will of course be necessary when vitamin intake must be larger than can be supplied by dietary adjustment without raising the intake of certain foods to a level which will result in a compensatory decrease in other essential foods. Such a condition may arise and may conceivably produce other deficiencies.

Among these are:

Grass juice factor—found in summer milk and in green grass which promotes growth of rats and guinea pigs.

Vitamins L_1 and L_2—lactation factors.

Factor W—a growth factor for rats, chicks and dogs.

Factors R and S—also growth factors for chicks.

The anti-gray-hair factor (anti-achromotrichia factor)—both para-aminobenzoic and pantothenic acids have been suggested.

Factor J—factor protective against pneumonia.

A new dietary factor for guinea pigs—found in cream.

TABLE 30

VITAMINS—THEIR FUNCTIONS AND IMPORTANT SOURCES

VITAMINS	BEST SOURCES	FUNCTION	DEFICIENCY SYMPTOMS
Vitamin A	Fish liver oils Liver and kidney Vegetables (green & yellow) Fruits (yellow) Tomatoes Butter Oleomargarine (fortified) Cream Cheese Egg yolk	Essential for growth functioning of the eyes structure and functioning of the cells of the skin and mucous membranes	Retarded growth Night blindness Gross anatomical changes in the eye Lowered resistance Changes in skin and membranes Defective teeth
Thiamine (vitamin B_1)	Pork Variety meats Soybeans Meat Oysters Melons Potatoes Milk Whole grain or enriched bread and cereals Vegetables (greens) Fowl	Essential for growth carbohydrate metabolism functioning of heart, nerves, and muscles	Retarded growth Loss of appetite and weight Nerve disorders
Riboflavin (vitamin B_2)	Variety meats Soybeans Milk Oysters Vegetables (greens) Meat Eggs Fowl	Essential for growth health of the skin cell activity functioning of the eyes	Retarded growth Lesions at corners of the mouth Dimness of vision Cataract-like symptoms Intolerance to light Inflammation of the tongue
Niacin (Nicotinic Acid) (a factor of the vitamin B complex)	Variety meats Meat Fowl Fish Peanut butter Potatoes Whole grain or enriched bread and cereals	Essential for growth utilization of sugar health of the skin functioning of stomach and intestines functioning of nervous systems	Glossitis (smoothness of the tongue) Skin eruptions Digestive disturbances Mental disorders

Pyridoxine (Vitamin B_6)	Meat (muscle tissue) Variety meats Fish Whole grain products Milk Legumes	Specific function unknown Probably essential for growth health of the skin functioning of muscles and nervous systems protein metabolism	Possible symptoms Skin eruptions Vague symptoms (insomnia, irritability, muscular rigidity)
Pantothenic Acid (a factor of the vitamin B complex)	Liver Meat Milk Whole grain products	Specific function unknown Probably essential for growth health of the skin Normal hair production	Undetermined
Vitamin C	Citrus fruits Melons Berries Other fruits Tomatoes Vegetables (especially raw)	Essential for growth cell activity maintaining strength of blood vessels development of teeth formation of supporting tissues	Sore gums Hemorrhages around bones Tendency to bruise easily
Vitamin D	Fish liver oils Fat fish Liver Milk (fortified) Eggs Irradiated foods Sunshine	Essential for growth regulating calcium and phosphorus metabolism building and maintaining normal bones and teeth	Soft bones Poor tooth development Dental decay
Vitamin E	Seed germ oils	Specific function unknown Probably essential for growth normal reproduction normal functioning of muscles and nervous systems	Undetermined
Vitamin *K	Vegetables (greens) Cabbage Cauliflower Soybean oil Tomatoes Orange peel Hemp seed	Essential for normal clotting of the blood	Hemorrhages

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Vitamins B_{12} and B_{14} involved in red cell formation.

Two additional currently interesting and important phases of vitamin knowledge should be noted. One is biosynthesis, and the other the antivitamins.

Biosynthesis is the formation of vitamins within the animal body. This is a new and important finding, since the original definition of the term vitamin includes the idea of "essential substances which must be provided in the diet because the body has been unable to manufacture them." Now it seems some vitamin synthesis can take place in the intestinal tract under the influence of bacteria—a fact brought to light by the use of the sulfonamides and their destructive action on bacteria.

Twenty-five years ago it was noted that experimental animals who had access to their own feces did not respond as did those who had not. It was suggested this was due to vitamins present in the feces. This curative effect was called refection. The extent to which this is possible is variable with animals and the various vitamins. More data and a clarification can be expected in the coming months.

For the present its practical application is an appreciation that it may influence human needs, and that when sulfonamides are given, or any drug, which decrease bacterial action, these may decrease the body's own production of vitamins and so unexpectedly result in deficiency. It indicates the need of high vitamin intake at such times. Research is active on this subject.

The other interesting finding is the existence of **antivitamins.** Not only are there antivitamins but antihormones as well. Isolated facts that had no explanation have gradually been pieced together, until today it is realized that substances very similar to the vitamins exist, and that they have neutralizing effect. Apparently the two compete for the same place in the tissue. One, the vitamin, is biologically active and permits normal function. The other is not, and when it replaces the vitamin, or exceeds it in amount, normal tissue function is hampered. It answers the question of why para-aminobenzoic acid could offset the effect of the sulfonamides; why high intake is a factor in pellagra; why feeding of raw fish to certain animals results in thiamine deficiency. Research has progressed to a point where

antivitamins have been found for thiamine, riboflavin, pantothenic acid, para-aminobenzoic, biotin, ascorbic acid, and vitamin K.

These findings undoubtedly will have far-reaching effects. The requirement values may need alteration, the vitamin values of food may need correction for antivitamin content, to express net vitamin content rather than total. It may be possible to produce deficiency states through administration of excessive amounts of antivitamin, which may alter our present concepts. It is complicated, and until the scientist has more time to unravel the mysteries of it, we may continue as before in our thinking and practice.

One other point rightfully should be discussed under the vitamins. That is the use of mineral oil. **Mineral oil** has been widely used and accepted as a mild purgative. The pros and cons of its value have no place here, but its effect on the absorption of the fat-soluble vitamins has. Its ingestion seriously interferes with the utilization of carotene, vitamin A, D, E, and K—the fat-soluble group. These are absorbed by the oil and leave the body without being released from it, thereby resulting in possible deficiency.

Review Questions

When and by whom was the existence of food elements other than proteins, fats, and carbohydrates first clearly demonstrated?

What were they called and why?

Before their chemical structures were determined, how were they designated?

What vitamin deficiency diseases are recognized today?

What should the human dietary include to supply adequately all the necessary vitamins?

Is self-medication with commercial vitamins advisable?

What results from an insufficient amount of vitamin A in the dietary?

What is the daily requirement of A?

What are good food sources of this vitamin?

What is the chemical name of vitamin B_1?

What disease results when it is lacking in the dietary?

What foods are good sources?

What vitamins are included in the term vitamin B_2 complex?

What are good sources of riboflavin?

For what specific disease is niacin a preventive and cure?

Name additional fractions of the B_2 complex. Are these proved to be necessary to human nutrition?

What is the chemical name of vitamin C?

What subclinical symptoms may result from an inadequate supply of this vitamin?

What are the most important sources?

What vitamin and what minerals are factors in the prevention of rickets?

Is this vitamin well supplied in food?

What foods are sources?

What are supplements to these food soarces?

What vitamin is essential for normal reproduction in certain animals?

What condition does vitamin K correct? Vitamin P?

What are the essential fatty acids which cannot be synthesized by the body?

What are good sources of these acids?

CHAPTER XI

MINERALS AND MINERAL METABOLISM

Minerals, the inorganic constituents of the diet, function in at least three ways: They are constituents of teeth and bone and as such give rigidity and relative permanence to the structures. They are constituents of all soft tissue. Held in solution in the body fluids, they influence the irritability of muscle and nerve and maintain the neutrality, osmotic pressure, and solvent power of these liquids. They yield no energy, and frequently are excreted unchanged. The minerals are occasionally ingested in free form, as sodium chloride (NaCl—table salt), but in general they are combined with organic substances.

While all the minerals are equally important, just as every element which is part of the structure of the cell is essential to life, specific attention need be given only to the inclusion of certain minerals in the diet; the others may be assumed to be supplied adequately in the average daily food.

The only minerals requiring special calculation in the diet are calcium (Ca), phosphorus (P), and iron (Fe) except when, due to disease condition, other mineral constituents of the diet may need adjustment (see section on Diet Therapy, Chapter XXVII).

Calcium, sometimes spoken of as an alkaline earth metal, is necessary for the normal clotting of blood (see also Chapter X, Vitamin K), and for the normal contractility of muscles. The alternate contractions and relaxations of the heart muscle are dependent upon the presence of calcium, sodium, and potassium in the fluid which bathes the heart. The blood calcium level is controlled by the parathyroid gland, which is a tiny gland in the throat, associated with the thyroid. Removal of the parathyroid gland from animals, or a decrease in calcium of the blood from any other cause, results in an increased muscular irritability or tetany (muscle spasm or convulsion). An increase in calcium level results in the reverse effect, extreme lethargy. An increase in potassium (K) has an effect similar to a decrease in calcium, and a decrease in potassium has an effect similar to an increase in calcium. The action is antagonistic.

Calcium is also concerned with nerve conduction and has been reported to have iron-sparing qualities (see paragraph on Iron below). Milk is the richest source of calcium. Without the inclusion of at least one pint of milk daily, there is inadequate intake of calcium. Fruits and vegetables, especially leafy vegetables, are rela-

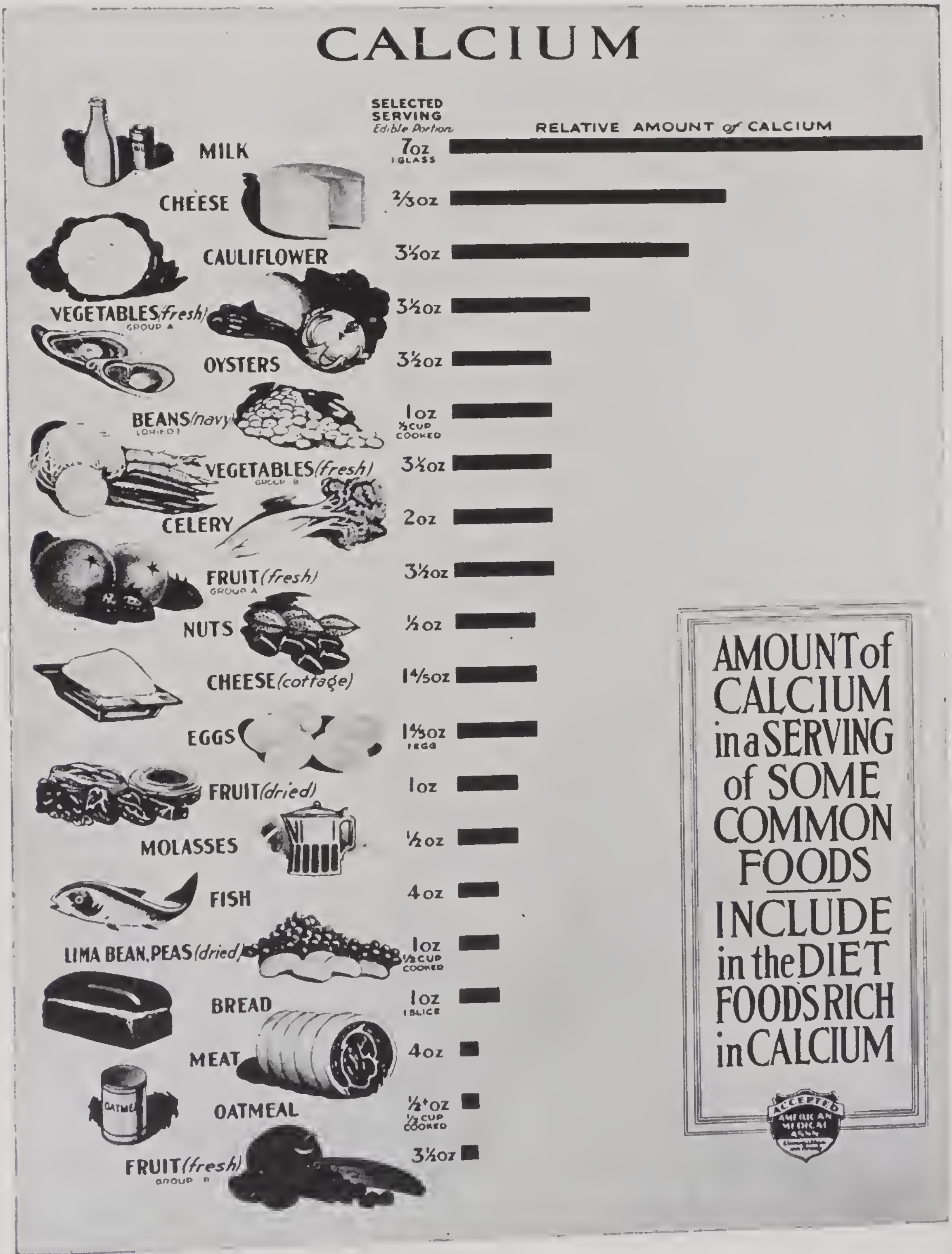

Fig. 60.—Food sources of calcium. (Courtesy of the National Live Stock and Meat Board, Chicago.)

tively rich in calcium. Sherman states that experimental evidence would indicate that the calcium of cabbage, collards, kale, leeks, lettuce, rutabaga leaves, and turnip tops is well utilized. The calcium of spinach, beet greens, and New Zealand spinach, however, is utilized very poorly, if at all. The difference is due to the oxalic acid content of the latter group which interferes with calcium utilization.

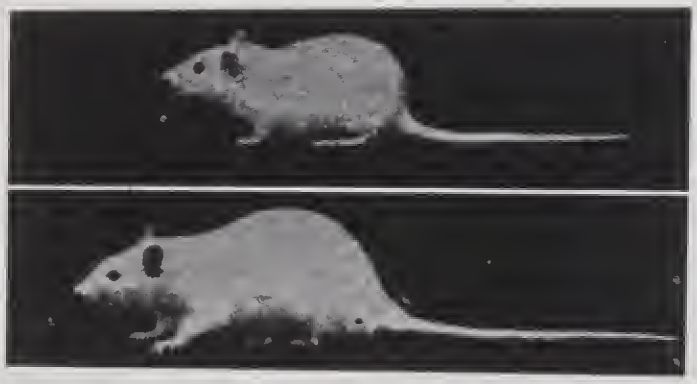

Fig. 61.—Rats from the same litter, 22 weeks old. The first rat did not have enough calcium. It weighed 91 gm. Note the short, stubby body, due to poorly formed bones. The second rat had an abundance of calcium and weighed 219 gm. Its bones are well formed. (Courtesy of the Bureau of Home Economics, United States Department of Agriculture.)

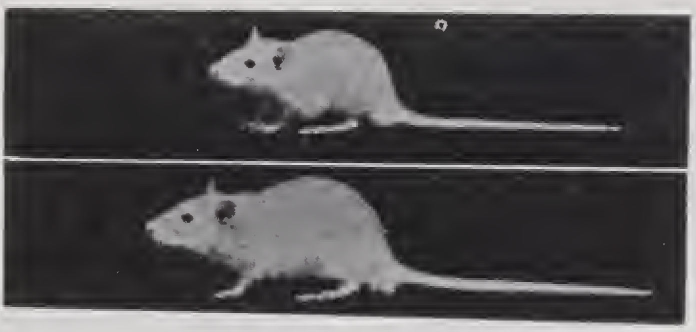

Fig. 62.—Rats from the same litter, 9 weeks old. The first rat did not have enough phosphorus and weighed only 60 gm. The second rat had an ample supply and weighed 115 gm. (Courtesy of the Bureau of Home Economics, United States Department of Agriculture.)

Feeding experiments indicate that orange juice exerts a favorable effect on calcium retention out of proportion to the calcium which it contains. Meats and milled cereals are poor sources of this mineral. One quart of milk supplies more than a gram of calcium (1.20 gm.) and in a form more readily utilized by the body than the calcium from vegetables. Cheese contains approximately 0.93 per 100 gm. (1 gm. per quarter pound), egg yolk 0.137 per 100 gm., dried beans 0.160 per 100 gm., and almonds 0.239 per 100 gm.

During pregnancy the calcium requirement is increased, and during lactation it should be even higher. Unless adequate amounts of calcium are supplied by food during these periods, the growing baby will draw its calcium from the mother's body stores.

TABLE 31

RECOMMENDED DAILY ALLOWANCES FOR CALCIUM

(Food and Nutrition Board, National Research Council, Sept., 1948*)

	Gm.
Man (70 kg.)	1.0
Woman (56 kg.)	1.0
During latter half of pregnancy	1.5
During lactation	2.0
Children up to 12 years	
Under 1 year	1.0
1-3 years	1.0
4-6 years	1.0
7-9 years	1.0
10-12 years	1.2
Children over 12 years	
Girls 13-15 years	1.3
16-20 years	1.0
Boys 13-20 years	1.4

*Critical review of the experimental evidence available regarding calcium usage has led to an increase in the amount recommended for the adult. The long accepted value of 0.8 gm. has been raised to 1 gm. The child 10 to 12 years of age has been adjusted to 1.2 gm. from a previous level of 1 gm.

For **phosphorus** the level compatible with safety is about 1.3 times the daily requirement for calcium. The interrelation of calcium to phosphorus is such that if either element is low, the other is not normally utilized, even though it be present in an adequate amount.

About 90 per cent of the phosphorus of the body is found in the bones and teeth. In addition, it is a constituent of every living cell. The phosphates (salts of phosphorus), especially the sodium and potassium salts, are important factors in maintaining the neutrality of body fluids (see discussion of Acid-Base Balance later in this chapter).

It has been said that compounds of phosphorus have a greater variety of function than any other nutrient. In addition to the above-mentioned roles, they are involved in the metabolism of proteins, fats, and carbohydrates of muscles, nerve, and brain, and in vitamin and enzyme activity.

TABLE 32

THE AMOUNTS OF EACH FOOD (UNCOOKED) WHICH WOULD SUPPLY THE DAILY CALCIUM REQUIREMENTS OF 1 GRAM

Almonds	40 (2 cups)
Apples, large	72
Artichoke, medium	50
Asparagus stalks, green 5 inches long	384
Bananas, large	80
Beans, navy (uncooked)	3⅓ cups
Beans, string	14 cups
Beef, lean	1 pound
Beets	18 cups
Bread, white, slices	129 (10 loaves)
Broccoli	5½ cups
Buttermilk	4 glasses
Cabbage, green	3½ cups
Carrots	11 cups
Celery, 6 inch stalks	51
Chard	5 cups
Cheese, American	2½ cubes (2″ × 1″ × 1″)
Cheese, cottage	6 tablespoonfuls
Cheese, cream	2 tablespoonfuls
Cherries, 30 per cup	21 cups
Clams	66
Collards	2½ cups
Dandelion greens	9 cups
Dates, dried, medium	214
Eggs, medium	33
Endive, stalks	96
Escarole	26 cups
Figs, dried, medium	43
Flour, wheat	2¼ pounds (9 cups)
Flour, white	14.5 pounds (58 cups)
Flour, soybean	1 pound
Kale	3 cups
Leeks	8½ cups
Lettuce, green leaves	145
Maple syrup	2 cups
Milk, dry skim, powdered	½ cup
Milk, evaporated, (undiluted)	2 glasses
Milk, sweetened condensed	2 cups
Milk, whole	1 quart (4 glasses)
Molasses, black	1.2 cups
Mustard greens	1 cup
Okra	7 cups
Oranges, medium	42
Parsnips	8⅓ cups
Potatoes, white, medium	77
Turnips	9 cups
Turnip tops	1½ cups
Watercress	5 cups

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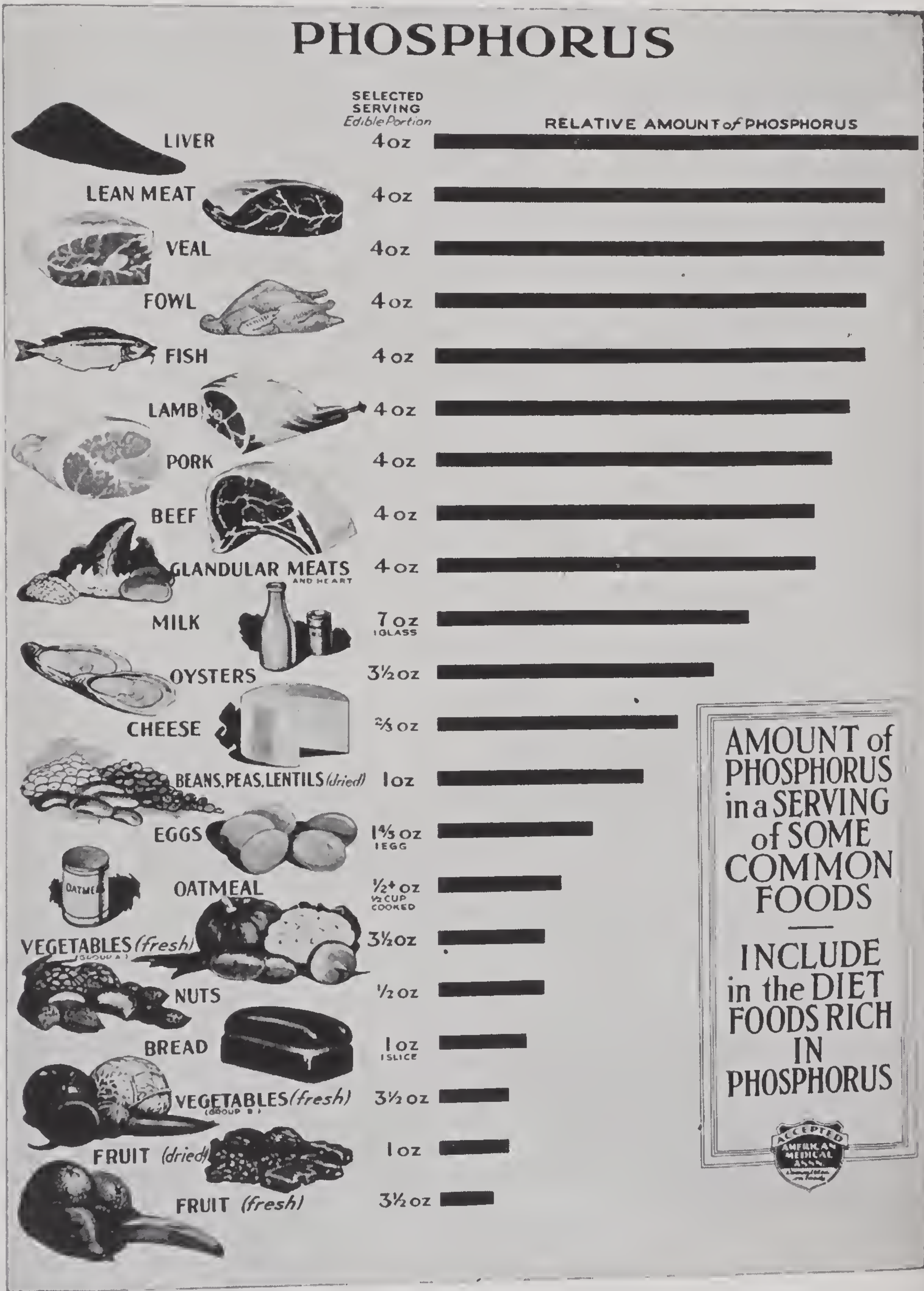

Fig. 63.—Food sources of phosphorus. (Courtesy of the National Live Stock and Meat Board, Chicago.)

Phosphorus occurs in foods as a phosphoprotein in the casein of milk, as a nucleoprotein in the ovovitellin of egg yolk, as a phosphorized fat (phospholipid) lecithin, and as phosphoric esters (salts) of carbohydrates, etc. Milk is an important source of

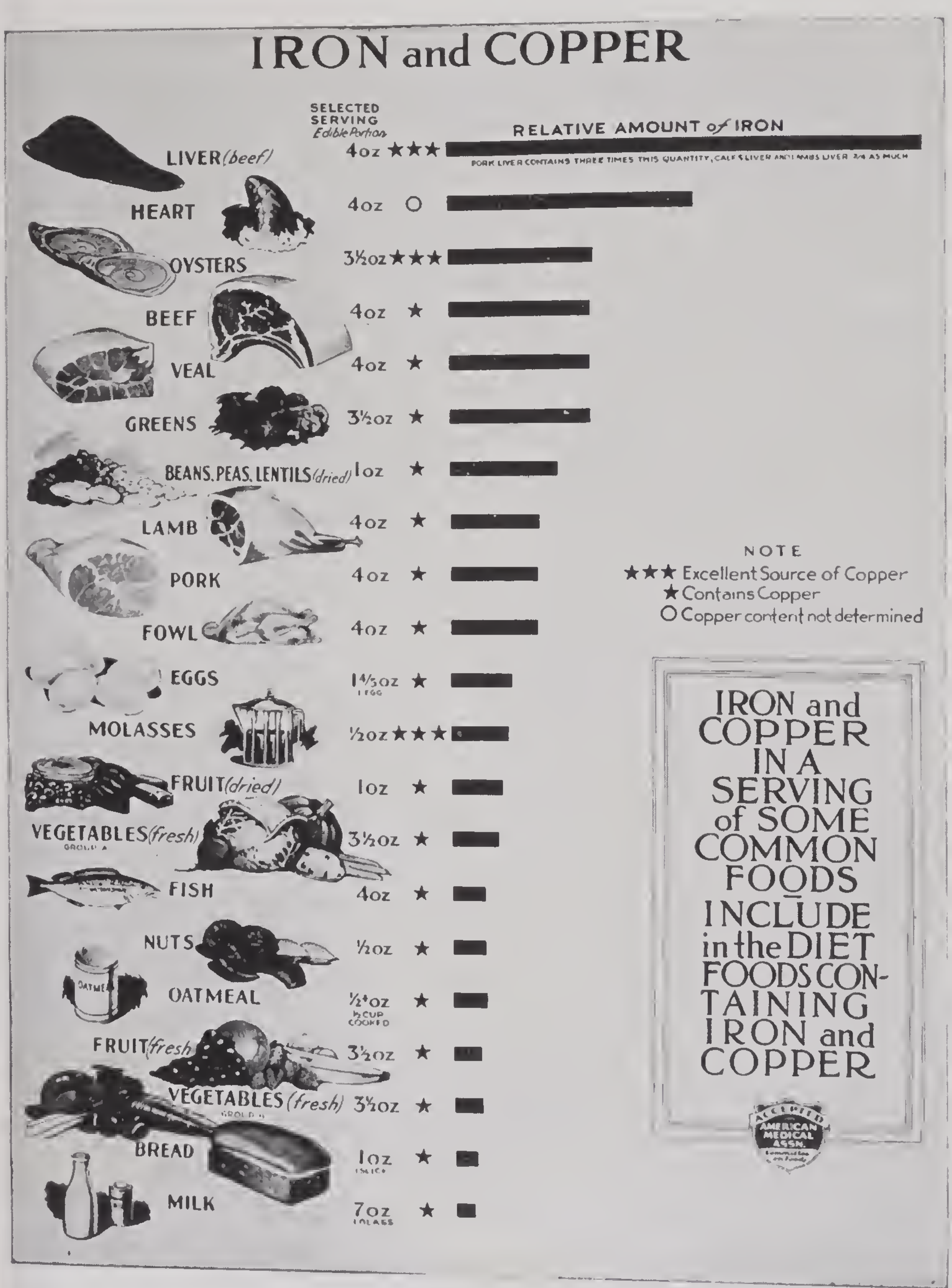

Fig. 64.—Iron and copper content of food. (Courtesy of the National Live Stock and Meat Board, Chicago.)

phosphorus (one quart contains 0.9 gm.), and meat, fish, fowl, egg, vegetables (especially the flowers and seeds), fruits, nuts, and cereals contribute good amounts. The daily requirement of phosphorus for the adult is 1.32 gm., or roughly one-third more than that for calcium. During pregnancy and lactation increased amounts are necessary.

Calcium and phosphorus are essential for bone and tooth structure. Approximately 98 per cent of all the calcium in the body is used in the building of skeletal tissue, which itself is 85 per cent calcium phosphate. When either of these minerals is lacking, there is stunting of growth, deformities, decaying of teeth, and rickets (a deficiency which results from inadequate amounts of vitamin D). Vitamin D regulates the utilization of calcium and phosphorus and is, therefore, essential for normal bone-tooth structure.

Iron is the third mineral for which calculation is made in dietary studies or dietary adjustments. Even though only small amounts are required daily (the entire body contains not more than 3 to 4 gm.), that small amount is of tremendous importance.

Interest has centered around iron metabolism, and new data are available. The small reserve is carefully conserved: only small amounts are excreted, and the rest is largely salvaged and reused. This fact explains why a more widespread incidence of anemia does not exist. Iron deficiencies can occur, and do, when the need is increased without increased intake, as in infancy when the liver reserve is gone and the dietary intake is not yet adequate; in childhood where blood formation is going forward; and due to menstrual losses, pregnancy, or hemorrhage.

It is interesting to know that if calcium intake is abundant, iron equilibrium may be established at a lower level. Calcium is said to exhibit a synergistic (supplementing or cooperating) action toward iron. Copper likewise exerts this synergistic action. Whipple and his associates conclude from their studies that a proper total mineral balance results in more effective utilization of iron.

When iron intake is inadequate or the body reserves are depleted, a specific anemia results. Hemoglobin, which gives blood its red color, contains iron. It has the ability to form a loose chemical combination with oxygen from the inspired air in the

lungs, and thus it is carried to all tissues by the circulation. When iron is low, hemoglobin is low, tissue oxidation is below normal as a consequence, and weakness and depression ensue.

The iron of milk is in a readily available form but is low in total content, there being only 2.4 mg. of iron per quart. This is only a fractional part of the day's requirement, which is set at 12 mg. by the Food and Nutrition Board of the National Research Council. To compensate for the low iron content of milk, the young, whose early diet is milk, are born with an extra supply of iron in the liver. The iron content of the baby's liver at birth is three times that of an adult.

Certain foods, notably liver, gizzard, kidney, apricots, peaches, and prunes, while rich in iron, are effective out of proportion to their content of iron in promoting blood regeneration in dogs made anemic by bleeding. Substances other than iron are present in these foods and give them added effectiveness. The iron content alone of any given food is not the measure of its ability to correct anemia, unless the anemia is due to low hemoglobin.

TABLE 33

RECOMMENDED DAILY ALLOWANCES FOR IRON

(Food and Nutrition Board, National Research Council)

	Mg.
Man (70 kg.)	12
Woman (56 kg.)	12
During latter half of pregnancy	15
During lactation	15
Children up to 12 years	
Under 1 year	6
1-3 years	7
4-6 years	8
7-9 years	10
10-12 years	12
Children over 12 years	
Girls 13-20 years	15
Boys 13-20 years	15

Iodine is necessary only in minute amounts, 0.002 to 0.004 mg. daily for each kilogram of body weight. This small amount is, however, essential. Iodine is used in the manufacture of the secretion of the thyroid gland, thyroxin. With insufficient

outpouring of thyroxin, there is decrease in metabolic rate, since thyroxin stimulates the oxidative processes in the tissues. When insufficient iodine is ingested, enlargement of the thyroid gland (simple goiter) results (see Chapter IX).

Goiter is prevalent in specific areas called goiter belts, where the iodine content of the environment is low. Sea water is relatively rich in iodine, and, therefore, as far as the salt spray can reach, or salt water seepage can go, iodine is adequately supplied by vegetables grown in those regions. Due to variability in environmental conditions, the minute traces of iodine found in foods, and the difficulty of analysis, reliable data as to food content of iodine are not available. Excess iodine can be stored in the body for future use, and experiments have proved that the administration of small amounts twice yearly for a period of two weeks to a month is good protection against goiter development. Iodized salt, which contains one part either potassium or sodium iodide to 5,000 parts salt, has had widespread use as a source of iodine. Such a product is used with safety to prevent simple goiter, but for the overactive thyroid it might be dangerous. Iodine treatment of goiter should always be carried out under medical supervision. Goats' milk, fish and other salt-water products, have a fairly high content of iodine, 100 to 400 parts per billion of dry food. Vegetables grown in nongoitrous regions, where iodine is a constituent of the soil, are fair sources of the element.

Sulfur enters the body as the amino acids cystine and methionine, components of the protein molecule. Approximately 1 per cent of protein is sulfur; therefore, if protein intake is adequate, the sulfur will likewise be adequate. Sulfur plays an important part in the oxidative process of the body, through the medium of glutathione, a sulfur compound. Sulfur is a constituent of hair and nails. Insulin, the secretion of the pancreas which governs carbohydrate metabolism, is a sulfur compound, and vitamin B_1, or thiamine, and biotin contain it. To a lesser extent sulfur is ingested as inorganic sulfate. Milk, whole grains, eggs, meat, peas, and beans are good sources of sulfur.

Sodium and **potassium**, while important constituents, require calculation to insure quantitative intake only in certain conditions, such as Addison's disease and cardiovascular disturbances.

Sodium and potassium are seldom lacking in food, in fact they are usually consumed in excessive amounts. Sodium is present in higher quantities in body fluids; potassium, in the body tissues and in liquids secreted by glandular organs, for instance, milk. These two minerals are not interchangeable; in fact, preponderance of either results in a disturbance in the water balance of the body. They function with calcium in regulating muscular irritability. (See appendix for new data on the extent to which these minerals occur in foods, and the discussion under Hypertension.)

Sodium chloride (NaCl) is the largest constituent of mineral matter of the blood. Its presence is of utmost importance in regulating water balance. In an ordinary diet the average individual ingests from 10 to 15 gm. daily, an amount far in excess of his needs. Five grams is a liberal allowance unless sweating is profuse.

When NaCl elimination is retarded for any reason, it follows that water will also be retarded by the tissues in an effort to have the salt solution of the tissue fluids of proper concentration. This water retention has distinct disadvantages. It may, therefore, be necessary at times to limit the intake, or to reduce it to a minimum. In such instances the salt may be reduced to 2 to 4 gm. Two grams is probably the approximate maintenance level. Reduction may be brought about by eliminating all salted foods, using no salt except the small amount needed in the preparation of food, avoiding salted butter, salted nuts, salted crackers, etc. It is, of course, possible to reduce further the intake by more drastic restriction. For example, saltless bread, salt elimination in any food preparation, and the washing and soaking of any food to dissolve off or out any inherent salt. Such low level is dangerous, however, since some sodium and chlorine are absolutely essential, and if continued too long drastic restriction will result in mineral imbalance, and loss of appetite will inevitably result because of unpalatability of the diet. This may lead to malnutrition and further body dysfunction due to deficiencies. Conversely, when profuse sweating, prolonged vomiting, or severe diarrhea have resulted in excessive salt loss to the body, extra salt should be provided to prevent tissue dehydration.

Salt (NaCl) restriction is practiced less today than sodium restriction. It has been found that it is the sodium ion and not the chloride which is the offender in water retention (400 mg. sodium is equivalent to approximately 1 gm. NaCl).

Chlorine. The major part of chlorine is combined with sodium to form sodium chloride. Chlorine as chlorides, particularly sodium chloride, is present in all secretions, excretions, and body tissues. The hydrochloric acid of the stomach arises from chlorine supplied to the gastric glands by the blood. The chlorides are among the most important of the body regulators. They control the osmotic pressure of body fluids, and thereby control the passage of water in and out of body tissues. This is a point of great importance in dehydration, where tissue water is greatly reduced, and in edema where tissue water is greatly increased.

Magnesium is present in the chlorophyll or green coloring matter of plants, and forms approximately 1% of bone and tooth structure. It is present also in all soft tissue and in body fluids. On a diet containing an adequate intake of plant and animal food, the magnesium requirement is easily met. However, if animals are maintained for a period of time on a diet devoid of magnesium, there is an increase in heartbeat, blood vessel dilatation, increase in irritability, and finally convulsions and death. Magnesium, therefore, is essential to life, although in just what manner has not been established.

Manganese is another element known to be essential to life, although its specific function is unknown. However, sterility in male rats and lack of maternal instinct in female rats, and a leg deformity in chickens (perosis) develop when maganese is withheld from the diet.

Copper is in general so closely associated with iron that adequate intake of iron assures adequacy of copper. Liver, oysters, molasses, chocolate, and cocoa are all excellent sources of copper. The 1948 recommended allowances suggest 1 to 2 mg. daily—approximately $\frac{1}{10}$ that for iron. Copper is an important factor in the utilization of iron for the formation of hemoglobin, rather than as a constituent of hemoglobin. McLester suggests that "it does not influence the assimilation of iron but acts merely as a catalyst in the transformation of this element into hemoglobin," thus giving it a function unique among the metals.

Fluorine has recently been studied with interest in connection with tooth disorders, in particular the mottled enamel known as fluorosis. Excess fluorine apparently interferes with the normal calcification of the teeth, so that they become structurally weak. The fluorine content of water in some localities is high enough to bring about such changes. This is an instance where excess, rather than deficiency, is serious. However, fluorine intake below a minimum level may be a causative factor in dental caries. (See discussion in Chapter XXV.)

Cobalt, bromine, aluminum, zinc, and other elements are found in very minute amounts. They are spoken of as trace elements, and their specific functions are unknown. The recent determination of the formula for vitamin B_{12} reveals the fact that cobalt is a constituent of that vitamin.

Shohl suggests the approximate daily requirements for the normal man as given in Table 34.

TABLE 34

Na	4.0 gm.	P	1.3 gm.	Fe	12.0 mg.
K	2.5 gm.	S	1.3 gm.	I	0.1 mg.
Ca	0.8 gm.*	Cl	6.0 gm.		
Mg	0.3 gm.				

*See 1948 recommended allowance.

Acid-Base Balance

The subject of acid-base balance is one of complicated chemistry and must appear so in spite of an effort to simplify. The simplest solution may be to omit it; however, *for the sake of the over-all coverage of the subject of nutrition, it seems wise to include a brief survey for those who desire to read it.*

In discussing the minerals it has been pointed out several times that they function to regulate the blood neutrality and to maintain the acid-base balance of the body. The elements calcium, sodium, potassium, and magnesium are alkaline. Phosphorus, sulfur, and chlorine are acid. The preponderance in a food of one group over the other is the deciding factor in determining whether that food will, after metabolic breakdown is complete, yield an acid or an alkaline (basic) ash, or will result in an acid or alkaline urine, inasmuch as the food constituents which are not taken up by the body are largely eliminated through the kidneys in the urine. Milk,

TABLE 35

SUMMARY CHART ON MINERALS

(Standards and values given for minerals may be changed as a result of further investigation)

NAME	DAILY REQUIREMENT	IMPORTANT SOURCES	FOODS THAT SUPPLY A DAY'S NEED*	SIGNIFICANCE IN HEALTH
Calcium				
Adults	1.0 gm.†	Dairy products— American cheese, buttermilk, milk (dried, evaporated, fresh)	1 quart milk or buttermilk *or* 1⅔ cups evaporated milk *or* 5 oz. American cheese *or* ½ cup broccoli and ¼ cup grated American cheese and ½ cup dried (skimmed) milk	Essential for building bones and teeth Necessary for normal heart action Necessary for growth and development Controls the contractility of muscles and preserves normal response of nerve tissue Necessary for the clotting of blood in case of injury
Children—up to twelve years	1.0 gm.	Molasses—		
Children—over twelve years	1.0-1.4 gm.	Vegetables— Broccoli, kale, mustard greens, soy beans, turnip greens		
Pregnancy	1.5 gm.			
Lactation	2.0 gm.			
Phosphorus				
Adults	1.3 gm.	Cereals— Oatmeal, whole grains	2 large glasses whole milk and ⅔ cup cooked oatmeal and 2 ounces cheese and ¾ cup of navy beans	Necessary for growth and development Essential constituent of every body cell Necessary for the formation of bones and teeth
Children	1.0-1.5 gm.	Dairy products— Milk, cheese		
Pregnancy and lactation	1.5 gm.	Eggs Meat and fish— Beef, liver, fish Nuts— Almonds, peanuts Vegetables— Asparagus, beans, broccoli, cabbage, carrots, cauliflower, lentils, peas, soy beans		

Iron			
Adults 12 mg.‡ Children—Infants 6 mg. One to six years 7-8 mg. Seven to twelve years 10-12 mg. Thirteen to twenty years 15 mg. Pregnancy and lactation 15 mg.	Meat— Liver, beef, oysters Molasses Eggs—(yolk) Cereals— Oatmeal, shredded wheat Dried fruits— Apricots, dates, figs, olives, raisins, prunes Vegetables— Beans (dried, lima), greens, chard, lentils, parsley, peas, watercress	5 oz. liver *or* 1 lb. meat *or* 8 eggs 2 cups beet greens *or* 1 cup cooked dried beans and ½ cup raisins and 2 tbsp. molasses	Essential in the structure of every cell Essential for the formation of oxygen-carrying hemoglobin of the blood Aids in the prevention of nutritional anemia, a condition in which the blood is below normal in hemoglobin Women are more susceptible to nutritional anemia than are men
Copper			
Adults 1 to 2 mg. daily Children 0.05 mg. per kilo body weight	Cereals— Bran, oatmeal, whole grains Eggs Meat and fish— Liver, seafoods Nuts Prunes Vegetables— Leafy vegetables, legumes	A diet supplying sufficient iron will usually provide adequate amounts of copper	Essential for the proper utilization of iron in the production of hemoglobin

Adapted from the chart prepared by the New York State Department of Health.
*These are suggestive only for adults.
†28.4 grams = 1 oz.
‡1 milligram = 1/1000 gram.

Table 35—Cont'd

Name Daily Requirement	Important Sources	Foods That Supply a Day's Need*	Significance in Health
Iodine Adults—0.15-0.30 mg. Children—0.002-0.004 mg. per kilo Pregnancy—Higher adult level	Fish— Salt water fish and other seafood Vegetables grown in nongoitrous regions—where the soil contains iodine	In nongoitrous regions, the requirement will be met by foods commonly used or by the use of iodized salt	Essential for normal functioning of the thyroid gland Deficiency may cause simple goiter enlargement of the thyroid gland
Salt (sodium chloride) Adults and Children—5-15 gm. 5 gm. entirely adequate	Table salt	Ordinary amounts used in seasoning Amounts should be increased when excessive loss occurs from perspiration due to heat or exercise	Essential in the regulation of body processes Controls the flow of water in and out of the tissues

Additional Minerals—

Potassium, sulfur, magnesium, manganese, cobalt, and zinc, are necessary in small amounts for normal health at all ages

Aluminum and silicon may be essential constituents of tooth enamel

General Functions of Minerals—

1. Constituents of bones and teeth, giving strength, rigidity and relative permanence
2. Constituents of soft tissues such as the blood, muscles, and organs
3. Regulators of body processes. Salts in solution affect the functions of muscles and nerves, osmotic pressure, and the ability of body fluids to dissolve materials, and aid in maintaining the neutrality of body fluids. Minerals supply materials necessary for the acidity or alkalinity of the digestive juices and other secretions

fruits, and vegetables are base-forming; cereals, meats, and eggs are acid-forming. It seems paradoxical that foods containing the fruit acids are reduced to an alkaline ash in the process of utilization, but this is quite true. Occasionally, as for instance in prunes, cranberries, and plums, an acid not utilizable by the body is present in sufficient amounts to mask the alkalinity of the minerals in the food, and the food then produces an acid urine. The degree of acidity or alkalinity of a food is expressed in terms of the quantity of normal acid or alkali to which it is equivalent (see Appendix, Table 114).

Blood and body tissues are nearly neutral in reaction (pH 7.4). When a solution is exactly neutral, it is said to have a pH (hydrogen-ion concentration) of 7.0. Below this value, i.e., pH 6.0, 5.0, etc., the solution becomes increasingly acidic, and above it, at pH 7.5, 8.0, etc., it becomes alkaline. The designation pH is used to express the balance between acid and alkaline elements. However, if the blood pH reaches 7.0 in the body, acidosis is present, and at 7.8, alkalosis. The ability of the blood to be held within such a narrow pH range is due largely to the blood buffers. This constancy is maintained in spite of wide variation in the pH of urine. Urine may be acid or alkaline. In addition to the buffers, two other factors are operative in maintaining this balance—the lungs and the kidneys.

Food, after digestion, is carried to the tissues where it is oxidized. The organic material which is not needed immediately is changed to carbon dioxide and water, and the mineral elements are set free. The acid radicals (elements) are immediately neutralized by alkaline radicals, if both are set free simultaneously. If not set free at the same time, they are neutralized by the **alkali reserve**. At all times there is an excess of alkali (largely sodium bicarbonate) held in the body as reserve alkali. When alkaline radicals in excess of those used to neutralize the acid radicals are released, they are added to this reserve store. This supply may be called upon at any time to release alkali for the neutralization of acid. When this need arises, the carbonic acid salts (carbonates) of the alkaline elements react with the circulating acid in such a way as to tie up that acid and release the weak carbonic acid. This carbonic acid is immediately and readily eliminated through the lungs as carbon dioxide and water. Obviously, if a diet devoid of sodium is in-

gested, the alkali reserve is depleted, and with this major buffer removed, the blood acid increases and **acidosis** probably results.

The term acidosis is loosely used. True acidosis is rare. In correct usage of the term only an upset in acid-base (alkali) balance of the blood results in acidosis. When an acidosis results from an incomplete combustion of fat, it is a ketosis (the acidosis of diabetic coma).

The blood neutrality is further maintained by the action of other buffers which are capable of tying up with free radicals, namely, the phosphates, amino acids, and proteins.

In addition, the kidneys may produce varying amounts of ammonia, which also functions to maintain neutrality.

See the appendix for a detailed table of the acid or basic effect of foods.

Review Questions

Of the many minerals important in human nutrition, what three require special calculation in the dietary? Why these three?

How do minerals function in the body?

What special functions does calcium fill? Phosphorus? Iron?

What is the standard daily amount recommended for an adult for each of these minerals?

What is the richest food source of calcium? Other good sources?

What foods contribute phosphorus? Iron?

Does age or sex affect the amount of these minerals needed?

What other minerals are necessary to human nutrition?

What minerals produce an acid ash after metabolic breakdown? What ones are alkaline?

What foods are acid forming? What base-forming?

How is the neutrality of the blood and body tissues expressed?

What mechanism keeps the body tissues neutral or nearly so?

CHAPTER XII

WATER BALANCE

Approximately three-quarters of the body weight is due to its water content and, in the opinion of Peters and his co-workers, about one-third of this is extracellular (outside the tissue cells) and two-thirds is within the cell itself. Disturbances of this equilibrium may be serious. Water-balance studies are steadily assuming importance. Water has greater importance than any of the foodstuffs. It is second only to oxygen. Life can go on many weeks without food, but cannot be maintained even one-half a week without water. In fasting practically all of the body fat and half of the body protein may be lost before death occurs.

Loss of 10 per cent of the body's water results in serious disorder; a loss of 20 per cent results in death. Death from water loss is not due to actual decrease as such, but to the upset in all of the metabolic processes due to the decreased availability of water. Every cell requires water both for structural existence and function.

Water is the basis of blood, which is the vehicle of transport within the body. By way of the blood food supplies and oxygen are carried to the tissues, and waste products, including carbon dioxide, are carried away to their port of exit. By means of its elimination through the skin, water is a factor in heat control. It is the solvent for urinary solids. With extreme water shortage or even sharp curtailment, kidney function is impaired. Water is the solvent for the body minerals and so basically aids in all their functions (see Minerals, Chapter XI). The tremendous value of adequate water, especially in illness, is evidenced by the much more rapid improvement when fluids are forced directly into the body tissues of those patients who are unable to take water by mouth in adequate amounts.

Water is made available to the body in three forms, as beverages, as preformed water in foods (milk is 87% water, fruits 85%, and even dry cereals contain 10% water), and finally, as the result of metabolic processes (metabolic water). When the body metabolizes food, water is one of the end points of the reaction; for example, Magnus-Levy found that 100 gm. of fat results in 107 gm. of

water, 100 gm. of starch results in 55 gm. of water, and 100 gm. of protein in 41 gm. of water. This metabolic and preformed water is utilized by body tissues just as though it were ingested water.

Water is lost from the body in several ways, by evaporation through the lungs and from the body surface, in the urine, and in the feces. While the major part (500 to 3,000 c.c.) is lost through the kidneys as urine, the amount lost by other routes may at times be appreciable (in feces during diarrhea, etc.). Soderstrom and DuBois outline a typical day (Table 36).

TABLE 36

Water Intake	Grams
Drinking water	300
Water in tea, coffee, etc.	580
Water in solid food (preformed)	720
Metabolic water from protein (100 gm.)	41
Metabolic water from fat (110 gm.)	118
Metabolic water from carbohydrate (244 gm.)	135
	1,894
Water Output	
In urine	750
In feces	300
Vaporized from skin and lungs	700
	1,750

While at times it may be necessary to alter fluid intake, the average intake as fluids of from 1,000 to 2,000 c.c. daily is satisfactory. To a large extent salt (NaCl) intake regulates this ingestion.

It has been suggested that a rough approximation of the water need may be made by allowing 1 c.c. for every calorie of expended energy. As a rule, two-thirds of this comes from food sources and one-third is ingested as fluids.

In general, thirst which depends upon food and NaCl intake, on activity and temperature, governs water intake. Water passes unchanged through the digestive tract and is absorbed largely from the intestinal tract. Only small amounts are absorbed from the stomach.

When more water is lost from the body than a corresponding amount of salt, thirst is immediately felt as indication of need for water intake. When salt losses are greater than the equivalent

amount of water which would be necessary to maintain the proper salt concentration of the tissues (the physiological salt level), characteristic symptoms develop—weakness and severe cramps, so-called heat cramps, since they may occur as a result of excessive perspiration due to heat or violent exercise. Administration of oral salt is necessary to correct this condition. Water alone will not, even though great water loss has also taken place.

On a weight basis children have a higher need for water than adults. For example, the infant has a requirement three times that of the adult—his extracellular water is twice as high, his metabolic rate greater, and his kidneys less efficient. Adequate fluid intake is especially important in the early years. Dehydration takes place quickly in children. See Table 68.

On the other hand, water intoxication can result when excessively large amounts of water are forced. The symptoms include nausea, vomiting, tremor, restlessness, frequency of urination and bowel movement, ataxia, convulsions, and coma.

TABLE 37

WATER CONTENT OF VARIOUS FOODS

FOOD	PER CENT WATER
Bouillons	96
Bread	30-45
Cereals (uncooked)	10
Cheese (cottage)	72
Cheeses (other than cottage)	30-50
Fish	50-80
Flour	10-12
Fruits (fresh or canned)	75-90
Meats (unless extremely fat)	50-70
Milk (whole)	88
Milk (skim)	92
Nuts	8-5
Soups	85
Vegetables	75-95

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Review Questions

Why is water of the greatest importance in the body?

What are the sources of water to the body?

What is another source in addition to food and fluid intake?

What is the total amount of water normally needed daily?

What percentage of the body water could be lost before a serious effect would result?

CHAPTER XIII

ROUGHAGE IN THE DIET AND ITS RELATION TO HEALTH

In order that the intestines may properly perform their function, there must be present in the diet a certain amount of roughage for the production of bulk. Very few foods are absorbed by the body to the point that no residue is left, and there is, therefore, a certain amount of undigested material naturally present which cannot be considered entirely waste matter because it plays this important role in intestinal activity. Some of our foods naturally leave a rather large proportion of residue, for example, the whole grain cereals, the leafy vegetables, and the fruits. In the normal diet there should not be an extreme in either direction. A well-planned diet is one that will produce an adequate amount of bulk for optimum gastrointestinal activity.

In addition to the bulk effect, Williams and Olmsted found from studies on medical students that a chemical stimulus arises from the action of bacteria on hemicellulose and cellulose. This fermenting material when mixed with the other fecal mass gives a stool of both bulk and soft consistency. Bran, carrots, corn germ meal, beet pulp, and cabbage were definitely laxative. Spinach, turnip greens, cauliflower, lettuce, celery, peas, beans, peaches, apples, pears, melon, and berries were also effective in promoting satisfactory bulk—especially when the fruit skins were also eaten.

This roughage, bulk, residue, or undigestible material is of two general classes, the harsh or rough roughage, such as the bran layer of cereals, the seeds of fruits and vegetables, and the skins of some foods. The softer roughage is composed of the indigestible fraction left by most fruits and vegetables. In some conditions it is wiser to plan for the second type of bulk. Bulk may also be obtained by ingesting one of the polysaccharides (see Chapter VI, Carbohydrates), such as agar-agar or psyllium seed. These substances, after absorbing water from the intestinal tract, swell to a soft bulky mass which passes as such through the intestinal tract.

Certain conditions require that bulk content be limited. This may be done by choosing concentrated foods that contain little residue, meats, milk, cheese, eggs, or by choosing such vegetables as the flowerlets of cauliflower, the top buds of broccoli, the tips of asparagus, young tender carrots, and other vegetables which might be rubbed through a strainer and leave no residue. Simply peeling fruit and removing the seeds may automatically throw it into this class of foods. The removal of the bran layers, with the adhering germ, from cereal products eliminates a good deal of roughage, but it must be borne in mind that when this is necessary, compensation should be made for the loss of minerals and vitamins contained in the bran and germ. This may be done by returning the wheat germ after it is separated from the bran to the "patent" or milled flour, or reinforcing the flour with crystalline vitamins. Or the wheat germ may be sprinkled on cereals and put into or on other foods and eaten. The germ has a residue content of only about 2 per cent and is an excellent source of the vitamins B and E. A diet containing cereal, and several servings of vegetable or fruit, in addition to meat, milk, and eggs, will contain a satisfactory bulk content for the normal individual.

Review Questions

Why is it necessary to have some roughage in the diet under normal conditions?

Distinguish between harsh and soft roughage.

What foods leave little residue after digestion?

How could the normal diet be adjusted to low residue or "smooth" diet?

CHAPTER XIV

FOOD ADJUNCTS

A word about food adjuncts, or those articles used in the diet which have no food value in themselves, but which give flavor and add variety. These adjuncts have a definite and important place and should not be eliminated from any diet unless such elimination is specifically necessary. Used in moderation they are not harmful; used in excess they may be irritating and may defeat their purpose by making foods less palatable. Even in the diet of the child and the invalid, the use of adjuncts in *moderation* is justifiable.

Table salt is usually classified under this heading, and to some extent it belongs there. The effect of NaCl on palatability needs no comment. Certain amounts, however, are essential to health (see minerals).

Vinegar, a dilute solution of acetic acid (4 per cent) and other substances giving it its flavor, adds savor to many otherwise flavorless foods. Pickling, or the preservation of foods by the use of vinegar, does, however, result in products less readily digested.

The **spices** owe their specific flavor to their volatile oils. "Spices" have been classified as stimulating condiments—cayenne, white and black peppers, mustard, and horseradish. The aromatic spices include allspice, anise, cinnamon, caraway, cassia, clove, ginger, mace, nutmeg, and the sweet herb group contributes dill, marjoram, sage, thyme, and savory. Variety may be given to an otherwise monotonous diet by the cautious use of spices, with perhaps temporary omission of the stimulating condiments during periods of gastrointestinal weakness.

Flavorings are available in great number. In general, they are prepared by soaking or grinding into alcohol the flavor-bearing product. Lemon and vanilla are the most commonly used extracts, but those of aromatic spices are also procurable—almond, mint, attar of roses, wintergreen, and others.

Tea, **coffee,** cocoa, and chocolate belong to the food adjuncts. Certain of their components have caused much controversy as to their inclusion in diets for other than the normal adult, and here again *moderation,* and proper preparation of the brew, are prob-

ably the answer. There is little evidence that the daily cup of coffee with breakfast has any adverse effect, and it may make the difference between enjoyment and nonenjoyment of a meal. It is certain that too often coffee is forbidden for no real reason. In coffee the important constituents are the alkaloid caffeine, caffetannic acid, and the volatile oil caffeol. Decaffeinated coffees (Sanka, Kaffee Hag) are available.

In **tea** the stimulating property is the alkaloid theine, which is identical with caffeine. The flavor of tea comes from the tannin and a volatile oil. The difference between green and black teas is in the preparation of the leaf for sale. Black tea, darkened by oxidative fermentation, has its tannin changed to a more soluble form than that in the original green leaf.

Excessive ingestion of the alkaloid and the tannin in either beverage results in overstimulation and irritation, and this should be avoided in health or in illness. Caffeine is known to raise blood pressure, stimulate the renal activity, and bring about a mild cerebral stimulation. It "clears the cobwebs." Coffee ingested with a meal slightly retards the emptying of the stomach and may thus increase the satiety value of the meal.

Chocolate and cocoa differ in their fat content, chocolate having roughly twice as much fat as cocoa. These two products likewise contain an alkaloid, theobromine. Excessive use of this alkaloid in the diet of children is contraindicated, but again moderation makes its use justifiable. Theobromine is similar to caffeine but does not exhibit its stimulating properties.

Recently there has arisen a popular idea that cocoa and chocolate have a marked effect on calcium utilization and that their addition to milk as in milk shakes, chocolate milk, or cocoa is ill advised. This is another example of scientific findings being overemphasized. It is true that cocoa contains oxalic acid and that oxalic acid ties up with calcium, forming an insoluble salt which results in calcium loss to the body. However, the amount of oxalic acid in cocoa and the amount of cocoa or chocolate in these drinks make the effect of the addition of little importance. From the standpoint of habit formation, plain or "white" milk probably is preferable, but the argument for it on the basis of calcium loss is a bit far fetched.

Soft drinks are in general sweetened, flavored water which has been carbonated under pressure. Such drinks are nonalcoholic and have *no food value except for their calories.* They contain approximately 10 per cent sugar.

A detailed discussion of alcoholic beverages has no place in a book such as this. They are food adjuncts, however, in the broad sense of the term. Within limits, alcohol may serve as a source of fuel. It has a caloric value of 7 calories a gram, and in amounts not to exceed 10 c.c. pure alcohol per hour it can be oxidized by the body and yield, at this level, approximately 70 calories, which can replace an equal calorie amount of carbohydrate or fat. Hence it does have a slight sparing action. It probably cannot supply energy for muscular work. It has no food value. Aside from the emotional, psychological, and depressant action, its ingestion in large quantities may decrease the intake of essential foods, a condition which is highly undesirable. Its excessive ingestion in addition to an adequate diet leads to obesity. When a calculated diet is necessary, alcoholic intake cannot be ignored. Again the watchword—"moderation marks the dividing line between desirability, nonharmful and harmful effects."

Review Questions

What value have vinegar, spices, herbs, and flavorings in the dietary?

Are tea and coffee contraindicated in the diet of the adult? What is their value?

How do chocolate and cocoa differ from tea and coffee? In what component are they similar?

What is the value of soft drinks?

Has alcohol any food or fuel value?

CHAPTER XV

FOOD HAZARDS, FOOD FADS, AND FOOD PROTECTION

In discussing food in relation to health the assumption is naturally made that a normal individual plus adequate diet equals health. However, at times an apparently adequate diet may actually result in ill health, and may directly or indirectly cause disease. Because of a food sensitivity or allergy (Chapter XLII), ingestion of a food may result in an undesirable reaction of varying degrees of severity. In this instance the individual and not the food is to blame, or the food may act as a vehicle for unfriendly organisms or worm infestations, or the food itself may be infected as in botulism, ptomaines, or in food poisoning. Food may be contaminated during the process of manufacture unless proper sanitary precautions are taken, and the contamination may be human or environmental.

Food Hazards

Typhoid fever in the past, more than at present, caused grave concern. Today we know it can be contracted only through carelessness in the observance of good sanitation, such as the disposal of human excreta. Carelessness here can result in underground seepage to wells, streams of water, or other water supply, and thereby cause spread of the disease. There may be improper supervision of the typhoid carrier, the individual who constantly harbors the typhoid bacillus in his intestinal tract without active sign of the disease, and who may never have had typhoid fever himself. This has resulted in more than one outbreak. Typhoid carriers should be kept from contact with any food supply. Various types of dysentery may become prevalent in a locality because of water supplies contaminated by human sources.

Tuberculosis, human or bovine, may be contracted from the ingestion of infected food.

In recent years many states have passed sanitation laws governing milk production. These laws require that all milch cows reacting to tuberculin test be destroyed. Pasteurization is rapidly

becoming compulsory. This practice and clean herds are becoming effective weapons in the elimination of at least the intestinal form of tuberculosis in man, which is of bovine origin.

Undulant fever and septic sore throat may be acquired through milk as the carrier of the disease organisms. Such milk is contaminated by the infected cow or the infection may come directly by contact with the animal itself. But milk may also be contaminated by the careless handler who may bestow typhoid, diphtheria, scarlet fever, or poliomyelitis-causing organisms.

Meats may be infested with tapeworm, and when eaten without proper cooking, infestation of the gastrointestinal tract is probable. Pork is not infrequently infested with a small round parasitic worm known as trichina which, as it migrates from the intestinal tract into the muscles, gives rise to a grave clinical condition known as trichinosis, in which the reaction is severe and frequently fatal.

The products of bacterial metabolism are another source of food contamination. In this group belongs **botulism.** The organism (*Bacillus botulinus*) under anaerobic conditions (in which no oxygen is present) grows in organic matter and produces a toxin. No change in flavor warns of its presence, although gas formation takes place and may cause bulging of the can of contaminated food. This bacillus cannot grow in acid foods, but is found occasionally in nonacid foods, such as canned meats, corn, beans, asparagus, and peas. Unfortunately, while the organism is killed in the canning process, spores (or undeveloped bacilli encased in a shell) may have formed. These are heat resistant and may escape the first cooking. Later they develop and release an active organism which in turn produces more of the toxin. This is why the afore-mentioned foods, particularly if home canned, should be brought to a brisk boil after the can is opened, before the food is even tasted. The reheating destroys any newly formed organisms and their toxic secretion. Botulism fortunately is rare today, because of modern vacuum-process canning methods. The mortality in botulism is high. The onset of symptoms is from eighteen to thirty-six hours after infection, and includes either severe gastroenteric or nervous system upsets, or both.

Ergotism is another example in which bacterial metabolism causes a toxin. This disease is caused by ingestion of "spurred"

rye, or rye on which the fungus parasite *Claviceps purpurea* has grown. Anesthesia and recurrent convulsions are the symptoms of this disorder.

Food poisoning may occur as the result of the presence of bacilli of the paratyphoid group (one of the intestinal groups). This infection produces diarrhea, vomiting, abdominal pain, and fever in from six to twenty-four hours after partaking of the infected food. Such contamination may occur in any type of food. Summer heat causes bacteria to multiply rapidly, and the need for additional care in the handling of food during this season must be emphasized.

Many cases of food poisoning are in no way traceable to infected food, but are caused by some temporary physical or psychic maladjustment on the part of the eater. Only when a group of individuals who have partaken of the same food are similarly affected, can one assume that the fault lies in the food eaten.

Many gastrointestinal attacks are erroneously called ptomaine poisoning by the laity. A **ptomaine** is a breakdown product of nitrogenous material (a product of bacterial action). In general and fortunately, by the time meat has reached the stage where this type of decomposition exists, it is ostensibly unfit for human consumption. The mechanical clinging of bacteria to meat, and the resulting entrance of the bacteria into the gastrointestinal tract, is not ptomaine poisoning in the correct usage of the term.

A third group of diseases results from the ingestion of **toxic substances, not of bacterial origin,** in plants which are not intended for human consumption. Poisonous fungi have been mistaken for mushrooms; the root of the water hemlock, or monkshood, has been mistaken for horseradish; and the young shoots of laurel for the wintergreen which they resemble.

Shellfish may be rendered unfit for food if taken from contaminated water. During the spawning season some fish should not be eaten.

Certain alkaloids, poisonous to man, develop in foods; for example, the increase in the solanin of potatoes during sprouting.

Occasionally accidental poisoning occurs. Foods may be roasted or dried in contact with coal gas which contains arsenic. Antimony may be absorbed by foods from cheap enamel-lined containers used for storage. This is especially true of food having high

tartaric acid content. Lead water pipes, tinfoil, old-fashioned tin cans, are all possible sources of lead poisoning, as is the lead in the paint on furniture which becomes a menace if the baby is a "cribber" and nibbles his crib. Today tin cans are coated with lacquer, so that no chemical action can affect the food, and can contents may, therefore, be left in the can after opening.

Food Fads

Food fallacies are rampant, and at a time when health, efficiency, and economy are important, it becomes increasingly necessary to sort these out from the scientifically accepted food facts and discard them forever. Clever advertising needs intelligent understanding as a weapon of resistance. Of course, no food is especially a "health food." Every food contributes to the health of the normal individual. Exception must be made for those who have digestive, absorptive, or metabolic derangement, or who suffer from special food idiosyncrasies or food allergy. And for the purpose of human nutrition, "every food is pure, when no injurious ingredient has been added in the processes of manufacture, storage, or distribution; when no spoilage or deterioration has taken place; and when no element of dietary importance has been removed from the materials produced by nature." No particular food "builds up resistance," can "purify" the blood, "break up a cold," or cure insomnia.

That food fallacies or superstitions were deeply ingrained is evidenced by the answers to a questionnaire sent in 1932, asking parents and teachers of elementary school children in 14 states if they believed that fish improved the brain. Fifty-nine per cent of the parents and 32 per cent of the teachers said "yes." Perhaps the knowledge that no one food is specifically a brain food is more general today than then, but the current prevalence of food fads is proof that the American public is still gullible. Such an idea probably arose from the fact that there are phospholipids in the brain and that there is phosphorus in fish. But so there is in other foods.

There are those who believe that water with meals is harmful or that it makes one fat. It is true that large quantities of cold water used to wash down mouthfuls of unchewed food is not desirable. Water, however, in moderation is advantageous. It

helps digestion by facilitating the mixing of the gastric juice with food. Twenty minutes after drinking ice water, the stomach's temperature is again that of the rest of the body. This is the same time interval for it to reach body temperature after drinking a hot beverage. Water has no caloric value.

Common "table salt" is accused of being responsible for cancer, high and low blood pressure, tuberculosis, Bright's disease, gray hair, and baldness.

Cream, cheese, and butter have been credited with being the cause of deafness, and pasteurized milk with bringing about heart lesions in children; fasting has been suggested as a cure for cancer and both milk and aluminum cooking utensils advertised as the causative factor. These claims obviously are known to be false by one trained in nutrition, but, unfortunately, too few have this information.

Physical work is reputed to require extra meat. Two generations ago scientists disproved the idea that muscle work demanded protein. Carbohydrate is the first source of body fuel.

Rich foods are indigestible! How frequently one hears this said. Digestibility or indigestibility is a question of completeness of utilization. Therefore, fats are very digestible. Ease of digestion is another matter. Fats do delay digestion and fat foods are usually compact and concentrated, hence they do take longer to digest. This time factor is a matter of no concern to the normally healthy person. It may, however, make it preferable to limit excessive fat for small children and those with impaired digestion.

Red meat is not less wholesome than white. As a general rule, cooked fruit is no more digestible than raw. Most fruits are perfectly digestible in the raw state when ripe. Unripe fruit is not poisonous but it is digested more slowly than the ripe fruit where the carbohydrate (starch) has turned to sugar. Starch requires cooking to be effectively handled by the human body. Bananas are very well handled, even by small infants.

Milk and sea food may be eaten in any combination and no difficulty will arise (if the food is unspoiled) unless some allergy or temporary disorder exists in the individual.

Seeds do not cause appendicitis; cheese and milk, even if boiled, are not constipating; clear coffee is not less harmful than when sugar and cream are added; garlic has no therapeutic value, etc.

The fads which may actually be harmful are those which control diet patterns. The vegetarian diet which contains neither milk nor eggs will undoubtedly be deficient in protein of high biological value.

Those who do not combine starches and protein, because one digests in alkaline media and one in acid, have only to study physiology to know that few foods are pure protein or starch. Foods are mixtures of foodstuffs—and what is more, when protein breaks down in the body, it yields practically one-half of its weight as carbohydrate (see Chapter VI).

Any easy way for rapid weight loss will of necessity involve a diet which is not properly adjusted. Of all diet fads, probably those designed for weight loss are most dangerous (see Chapter XVIII). For the intelligent person, the subject of "Hollywood diets" can be dismissed with the single word DON'T!

Food Protection

Lest these possible hazards and exaggerated claims make one overapprehensive, the efforts to combat them should be mentioned. The consuming public is now protected, so far as legislation can protect, from food which is not as it should be. The Federal government regulates interstate commerce and that of foreign nations with our shores. The states have the power to legislate for the protection of the peoples within their boundaries. These powers have cooperated in passing specific and general sanitation laws. In 1906 the Federal Food and Drug Act, popularly known as the **Pure Food Law,** was passed. This defines what may be considered as adulteration and misbranding. It imposes upon the Secretaries of the Treasury, Agriculture, and Commerce, the formulation of rules and regulations to carry out its provisions. As a result of the law in its original form, and as amended, agents of the Department of Agriculture may collect and analyze samples of any manufactured food products. If such food does not meet government standards, the manufacturer or his attorney must explain the discrepancy. If he is at fault, the case is given to the Department of Justice for settlement. In 1938 the Federal Food, Drug and Cosmetic Act was enacted to replace the Act of 1906, not to replace its control but rather to extend the regulations as the title indicates.

Standards of purity, definitions, or methods of analysis, or related questions, are referred to a joint committee, composed of representatives of the United States Department of Agriculture, the Association of American Dairy, Food and Drug Officials, and the Association of Official Agricultural Chemists.

Various congressional bills have set up regulations for specific food products, and the states have local laws which ratify them so closely that country-wide sanitary protection is assured.

The American Medical Association has formed two committees for the approval or acceptance of foods and drugs. For acceptance, manufacturers must fulfill and maintain certain standards of quality. The Committee's seal is assurance that the advertising of such products is truthful. The two committees are known as the Council on Foods and the Council on Pharmacy and Chemistry. The former publishes its findings and recommendations in their publication *Accepted Foods,* and the latter in *New and Non-Official Remedies.* Both committees are composed of outstanding men and women, whose basic training and experience enable them to pass judgment.

Food as purchased today, therefore, can be considered safe for human consumption. What happens to it within the home is beyond the control of anyone except the homemaker. Her intelligent care in its preparation should prevent any adverse condition from developing betwen the time of purchase and consumption.

Review Questions

In what ways may humans be protected from contracting typhoid fever?

Why are rigid laws governing milk production necessary?

What are the organisms which may infest meat?

What is botulism? What precautions are necessary in serving nonacid canned foods, especially home canned?

Distinguish between food poisoning and ptomaines.

What are some additional food hazards?

What is the greatest bulwark against food fads?

What protection have we against food hazards?

CHAPTER XVI

A REVIEW CHAPTER ON THE ESSENTIALS OF AN ADEQUATE DIET

Many years ago Carl Voit defined food as a "palatable mixture of foodstuffs which is capable of maintaining the body in an equilibrium of substance, or capable of bringing it to a desired condition of substance." The ideal food, he further stated, "is a palatable mixture of foodstuff arranged together in such proportion as to burden the organism with a minimum of labor." An analysis of that definition indicates the completeness of his understanding.

Food to be utilized most efficiently must be palatable, and it must be eaten with enjoyment. It must be attractive in appearance and it must satisfy. In order to have adequacy, there must be a mixture of foodstuffs in total readily utilizable from the standpoint of digestion. The amounts and properties of the food stuffs in the mixture must be such that balance may be maintained between intake of necessary nutrients and outgo of waste products. That such equilibrium is essential, is demonstrated by feeding experiments, in which one or more dietary essentials are inadequate or lacking, and study of the profound effects which follow restricted diets. Such experiments clearly indicate the potential dangers of our frequently lax food habits. McLester, in a discussion of the normal diet, expressed the idea that man's place in future history will depend in no small degree upon the food which he eats. McLester is by no means alone in this belief; therefore, the first consideration in diet construction should be to keep the individual in a state of good nutrition or to bring him to this condition for his own sake and for the sake of posterity.

When a diet is to be taken for only a short time, the nutritive balance is of relatively small importance, but when it must extend over a long period, it must be adequate if deficiency diseases or their subclinical symptoms are to be prevented. Preventive medicine will eventually begin with diet adjustment. Malnutrition, whether its source be lowered caloric intake, specific shortage of any one food, or imbalance between food constituents, always re-

RECOMMENDED DAILY DIETARY ALLOWANCES*
1948 REVISION
Food and Nutrition Board, National Research Council

	CALORIES	PROTEIN GM.	CALCIUM GM.	IRON MG.	VITAMIN A I.U.	THIAMINE MG.	RIBOFLAVIN MG.	NIACIN MG.	ASCORBIC ACID MG.	VITAMIN D I.U.
Man (70 kg.)										
Moderately active	3000	70	1.0	12	5,000	1.5	1.8	15	75	†
Very active	4500					1.8	1.8	18		
Sedentary	2400					1.2	1.8	12		
Woman (56 kg.)										
Moderately active	2400	60	1.0	12	5,000	1.2	1.5	12	70	†
Very active	3000					1.5	1.5	15		
Sedentary	2000					1.0	1.5	10		
Pregnancy (latter half)	2400	85	1.5	15	6,000	1.5	2.5	15	100	400
Lactation	3000	100	2.0	15	8,000	1.5	3.0	15	150	400
Children up to 12 years:										
Under 1 year‡	110/Kg.	3.5/Kg.	1.0	6	1,500	0.4	0.6	4	30	400
1-3 years	1200	40	1.0	7	2,000	0.6	0.9	6	35	400
4-6 years	1600	50	1.0	8	2,500	0.8	1.2	8	50	400
7-9 years	2000	60	1.0	10	3,500	1.0	1.5	10	60	400
10-12 years	2500	70	1.2	12	4,500	1.2	1.8	12	75	400
Children over 12 years:										
Girls 13-15 years	2600	80	1.3	15	5,000	1.3	2.0	13	80	400
16-20 years	2400	75	1.0	15	5,000	1.2	1.8	12	80	400
Boys 13-15 years	3200	85	1.4	15	5,000	1.5	2.4	15	90	400
16-20 years	3800	100	1.4	15	6,000	1.7	2.5	17	100	400

*This table is for the use of nutrition experts. 1 mg. thiamine equals 333 U.S.P. XI units; 1 mg. ascorbic acid equals 20 U.S.P. XI units. Vitamin A requirements may be less if provided as vitamin A; greater if provided chiefly as the provitamin carotene. Allowances for children are based on needs for the middle year in each group (as 2, 5, 8, etc.), and for moderate activity.

†Vitamin D is undoubtedly necessary for older children and adults. When not available from sunshine, it should be provided probably up to the minimum amounts recommended for infants.

‡Needs of infants increase from month to month. The amounts given are for approximately 6-18 months. The amounts of protein and calcium needed are less if derived from breast milk.

National Research Council, 2101 Constitution Avenue, Washington 25, D. C. See Recent Revisions in Recommended Dietary Allowances, P. C. Jeans, J. Am. Dietet. A. 25: 13, 1949.

sults in decreased efficiency. Sound structure cannot be built without building material proper in kind and in amount. Man can accommodate himself to inadequate intake for a certain length of time, but eventually he will suffer if it is continued too long.

To simplify planning of the normal diet, specific points should be remembered. These are included in the Recommended Daily Dietary Allowances (1948 Revision) Table 38.

I. **The calorie requirement.**

In the discussion of Metabolism it is stated that calorie requirement varies with size, sex, occupation, and other factors. A general average for a man doing moderate work is approximately 2,800 to 3,000 calories per day, and for a woman from 2,200 to 2,500. Weight loss or weight gain soon indicates need for increased or decreased calories (see Chapter XVIII, Weight Control). A simple calculation to approximate caloric requirement is to multiply the height of the individual in inches by 40 calories. Or in the adult it may be calculated as 35 to 40 calories for each kilogram of *preferred* weight (roughly, 25 calories under basal condition, 30 at bed rest, 35 at light exercise, 40 for moderate exercise, and 50 for severe activity). Supplying calories to meet the chosen weight naturally tends to bring the body to that weight.

II. **The protein requirement.**

Protein level is the second point in importance. High and low protein intake have both been advocated. An intake of protein well above the metabolic requirement, but below the extremely high levels, seems the most desirable. On the average present-day diet the protein supplies from 10 to 15 per cent of the total calories, or approximately 1 gram per kilogram body weight, at a 10 per cent level, which is 70 gm. for the average man and 1.5 gm. at a 15 per cent level. It is wise never to permit the level of protein intake to fall below 0.7 gm. per kilogram, or a total of 50 gm. daily. If this occurs, insufficient protein is supplied to meet the daily wear and tear of body tissues, the tissues themselves are burned, and protein deficiency occurs. Even when theoretically the lowest possible protein intake is desired, an intake below 0.7 gm. per kilogram may result in symptoms as harmful as those the diet was planned to alleviate. When a low level of protein is used, protein of high biological value (animal proteins, such as milk,

cheese, eggs, meat, fish, and poultry) should be ingested. If the proteins of low biological value are substituted, a specific deficiency of one or more of the essential amino acids may result (see Chapter IV, Proteins).

With the higher protein intakes (as high as 2 to 4 gm. for a child), some protein of lower value, beans, peas, lentils, gelatin, etc.) can supplement the animal group.

One authority suggests a distribution of protein as follows: 19% milk, 28% meat, 18% eggs and cheese, 16% fruits and vegetables and 19% from cereals—or ⅓ from vegetable sources and ⅔ from animal sources. However, an equal amount of animal and vegetable protein is a practical and safe proportion and is more economical if this is a factor.

III. **The fat level.**

In the normal diet, fat supplies 25 to 45 per cent of the total calories, 75 to 150 gm. daily, or 1 to 2 gm. per kilogram of body weight. Since carbohydrate more effectively spares body protein than does fat, and since fat in too large amounts may not be well tolerated, a fat intake not to exceed 45 per cent of the total calories is preferable to a higher intake, unless the higher intake is specifically indicated.

The higher the fat the more costly the diet. When strict economy must be practiced, the diet must necessarily be of high carbohydrate content. See page 72 for a discussion of the possible value of lower fat levels.

Changes in the quantity of fat in the diet may be a means of regulating appetite, since the higher the fat content of a meal the longer it stays in the stomach, and the longer hunger pangs are deferred.

IV. **The carbohydrate intake.**

Carbohydrate normally supplies roughly 40 to 50 per cent of the total calories, from 4 to 5 gm. per kilogram, or a total of 300 to 400 gm. Starches form the bulk of the carbohydrate eaten. They are the cheapest source of energy and are neutral enough in flavor to be well adapted to liberal use. The cereals, cereal products such as breads, etc., and the 15 to 20 per cent vegetables are the chief sources of starch. The fruits, sugars, and desserts supply the sugar.

V. **The minerals.**

While no one mineral is of greater importance than another (see Minerals, Chapter XI), in general practice only three require calculation to assure adequate intake. These are calcium, phosphorus, and iron. Sufficient protein in the diet insures sufficient sulfur. Sodium and chlorine are provided in excess as seasonings. The potassium content of vegetables is high. But deficiencies of calcium, phosphorus, and iron do occur. Standard or optimum intake values, which are sometimes suggested, include a margin of safety. The optimum is the minimum requirement of these constituents plus 50 per cent.

For children the calcium and phosphorus should be 1 and 1.5 gm., respectively. Milk must be included for the phosphorus and calcium. All the calcium and half the phosphorus are supplied by three-fourths quart of milk.

VI. **The vitamins.**

Even though the specific deficiency diseases seen in animals are rarely encountered in man, lowered resistance to infection and numerous vague clinical symptoms are known to be attributable to low vitamin intake. It is entirely possible to meet the *normal* vitamin requirement, with the exception of vitamin D, by means of food.

Vitamin A is abundantly supplied by cream, butter, cheese, milk, highly colored fruits and vegetables, liver, egg yolk, and salmon. If the diet contains a pint of milk, a serving of butter, a leafy or colored vegetable and fruit, a protein such as cheese, egg, liver, or a dark-colored fish, the vitamin A requirement of the normal individual will be met.

Vitamin B. This group may, for simplicity, be considered together. Liver, whole grain cereals, milk, molasses, and yeast yield good amounts of vitamin B, while vegetables, fruits, and nuts are appreciable sources of all of this group. If the daily food contains a pint of milk, a whole grain, a partly milled, wheat germ-reinforced, or crystalline vitamin padded cereal, a serving of fruit, a leafy vegetable, and a serving of meat (particularly liver), the B group of vitamins will be supplied in adequate amounts.

Vitamin C is obtained in excellent amounts from the citrus fruits. An orange or half a grapefruit contains nearly enough

to meet daily requirements. (The frozen and canned juices have essentially the same vitamin C value as the fresh fruit.) Cabbage, cauliflower, broccoli, strawberries, and raspberries are excellent sources, and most fresh vegetables and fruits are good sources. Raw vegetables should be used where practical. Salads are rich in vitamins.

Vitamin D is rather restricted as to natural sources. It is the one vitamin that requires supplementation by commercial products during the period of growth, especially when sunlight is not available. A fish oil should be considered as food in the diet of the child, not as medication.

Vitamin E is found in abundance in natural products. Vegetable oils, margarines, wheat germ, whole grain cereals, and to slightly less extent, dairy products and milk, are satisfactory sources. The suggested requirement for the normal adult is 25 mg. daily.

The other vitamins of which we hear are still undergoing experiment, and as yet need cause no concern. Physical ailments from their lack have not yet been proved. We may well assume that since they are closely associated with the familiar vitamins, sufficient amounts of the one group will insure the presence of adequate amounts of the other.

Vitamin K deficiency occurs only when faulty absorption of fat exists, or there is liver dysfunction of such nature that the vitamin is destroyed. If the diet contains an abundance of green leafy vegetables, deficiency could result from such pathologic change only.

VII. **Water.**

Water plays an important part in good nutrition. It is available to the body from three sources: ingested as such or as tea, coffee, fruit drinks, and other beverages; as preformed water which is part of the composition of the food (milk is 87% water, fruits and green vegetables 75 to 90%, ready-to-serve cereals contain 10%); and lastly the metabolic water which results in the oxidative breakdown of food (see Chapter XII, Water Balance). In general, the intake of fluids as such should not fall below 1,000 c.c. (1 quart) per day.

VIII. **The bulk of the diet.**

Roughage or bulk is necessary if normal intestinal activity is to take place. There is general agreement that abundant fruits and vegetables should be included in the normal diet. The cellulose framework of these foods resists digestion in man and is eliminated from the body as roughage. Just how much roughage should be supplied is a question. In certain types of constipation roughage is undesirable. The use of the new "enriched," "restored," or "reinforced" milled flours and cereals assure products with a vitamin potency equal to the whole wheat flour but devoid of roughage. The quantity and quality of bulk to be included in the diet must be settled by individual experimentation.

IX. **The acid-base balance.**

Certain foods because of their mineral content leave an acid ash, or produce an acid urine. Other foods leave an alkaline ash as the end product of metabolic process. The determining factor is the predominating mineral (see Minerals, Chapter XI).

Foods are classified as acid-forming or base-forming. Meat, fish, eggs, and cereals are acid-forming. Milk, vegetables, and fruits, with the exception of prunes, cranberries, and plums (see Minerals), are base-forming. Fats, sugars, and starches are neutral. The normal diet should be neutral or slightly alkaline. Original organic acidity, such as the tartness of oranges, due to their citric acid content, should not be confused with the acidity as an end result of metabolism.

X. **Food idiosyncrasies.**

Unnatural food habits may be due to notions or to food allergies. If they are due to the former, psychologic adjustment should be undertaken. If to the latter, the allergy should be strictly observed. When, however, a food which is a dietary essential must be omitted from the diet, *it is imperative that it be replaced by some other satisfactory food or commercial product* which will offset the elimination of the particular food. Allergy may seriously alter meal planning (see Chapter XLII).

XI. **General.**

The attractiveness, palatability, suitability, and cost of any diet are matters of importance. In addition, general eating habits,

health habits, physical surroundings, and psychologic response can, if they are adverse, offset many advantages of a proper diet.

Gove Hambidge says in *Your Meals and Your Money:** "After all the analysis and pulling apart has been done, perhaps the larger significance of food study lies in three things. It seems to indicate very clearly: That diet is a primary factor in enabling the individual to realize the highest physical well being of which he is capable within the limitations of his inheritance. That whatever specific factors are responsible for specific results, it is the whole picture that counts, the whole diet, the whole body, and the whole life. That to attain the really profound effects of a superior diet takes a lifetime or even more than one generation. All this opens up a new point, a sweeping panorama indeed, and a new field of effort to the science of nutrition; and by the same token, as Sherman has pointed out, it greatly increases the responsibility of the nutritionist in relation to human welfare. Nobody has ever tried feeding a nation like a herd of thoroughbred animals, just to see what would happen, but I should like to see America start trying it."

Review Questions

What factors affect the efficient utilization of food?

What results may follow if an inadequate diet is continued over a prolonged period?

For a man doing moderate work, approximately how much energy does he expend in terms of calories? A woman?

In what two ways may the calorie requirement of an individual be approximated?

In what two ways may the protein need of an individual be calculated?

What is the minimum amount of protein for an adult below which it is unsafe to go?

What percentage of the total calories is normally provided by fat? What percentage by carbohydrates?

What are the reasons that milk is such an important constituent of the diet at all ages?

According to our present knowledge, what vitamins are considered of primary importance in human nutrition?

What is meant by acid-base balance?

In addition to food nutrients in proper kind and amount, what other factors must be considered if optimum nutrition is to be attained?

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CHAPTER XVII

PLANNING THE FAMILY DIET

We know from scientific studies what is essential for normal, optimum nutrition, but how shall the meals be planned? This is not a complicated matter. The daily or weekly inclusion of certain basic foods or food groups is assurance that fundamental requirements will be met. After these foods have been included, the remainder of the diet may be made up from foods of choice.

The first essential is **milk.** If the daily diet contains 1 quart of milk, there is at once protein of the highest quality, fat, and carbohydrate (see Chapter IV). All the calcium needed, two-thirds the requirement of phosphorus, one-third the needed vitamin A, one-half the requirement of vitamin B_1, and over half of the vitamin B_2 will be present. If only a pint of milk can be included each day, it will go a long way toward meeting requirements, but not in optimum amount.

The milk may, of course, be drunk as such or made into cocoa, cream soups, puddings, sauce for vegetables, or it may replace water in preparing cereals. Cheese may be used to replace part of the milk intake. The cheese equivalent of one quart of milk is approximately one-fourth pound, depending upon the texture. When cheese replaces milk, however, it must be remembered that part of the minerals, the water-soluble vitamins, and the major part of the carbohydrate have been lost in the whey. If skim milk cheese is used, there is additional loss of cream or fat.

Other equivalents for the quart of milk are the pint can of evaporated milk (16 ounces), 4½ ounces of dried whole milk, or 3½ ounces of dried skim milk plus 1½ ounces of butter.

As a second essential a **cereal** or cereal product should be eaten every day in addition to bread. Breakfast foods today offer a wealth of choice. We have wheat, oats, rice, corn, barley, buckwheat, and rye in their natural state, as well as the multiplicity of prepared cereals. Besides the breakfast foods we have a great variety of pudding materials, tapioca, rice, sago, corn, and others; and in addition to bread we have muffins, rolls, biscuits, waffles, griddlecakes, and crackers. Choice should be a pleasant task. The preference should be for the whole grain, nearly whole

grain, wheat germ-reinforced, or enriched cereals or cereal products. As has been stated before, the outside husk is removed in the finely milled cereals, consequently the minerals and vitamins are no longer present. The cereal is then of value only as a source of calories and for its satiety value. With the possible exception of wheat and oats, the husk of most cereals is not too rough to prevent its inclusion in the normal diet. The bran layer of wheat and oats may be contraindicated for some individuals. To compensate for this, however, wheat germ may be used separately, or milled flour containing wheat germ or flour reinforced with the crystalline vitamins may be purchased. Wheat germ is rich in the vitamin B complex and in minerals, but has very little roughage.

The cereal group is, of course, of high caloric value, and because of its blandness may be included in good quantity. In addition, cereals furnish bulk, to varying extent (when not finely milled), and are excellent sources of phosphorus, sodium, magnesium, sulfur, and iron, and the vitamin B complex. Three to four servings during the day, as a cereal or "bread," is desirable.

The third essential is **vegetables**, of which there is a variety. The 5 per cent vegetables, those leafy green salad vegetables, are rich in minerals, and vitamins (A, B complex, C, E, and K), but are low in protein, fat, and carbohydrate. In raw salads they retain their vitamins and minerals. If they are cooked, care must be exercised to prevent dissolving out the minerals and water-soluble vitamins. One 5 per cent vegetable should be included in the diet daily as a salad, unless a raw fruit salad or raw fruit alone is served. A second vegetable should always be included from the 10, 15, or 20 per cent group in addition to potato—or a total of three, one of which should be raw, if possible. In general the vitamin and mineral content of these last-mentioned vegetables is lower, but their calorie value is higher, and unless a low calorie diet is desired, these vegetables add variety, color, and satiety.

Fruits are similar in composition to the vegetables, the difference being largely a matter of a sweet carbohydrate (sugar) in place of starch. To insure adequate intake of vitamin C, it is wise to include routinely a citrus fruit in the daily diet if cost permits and if there is no sensitivity (allergy) to citrus fruits. If the citrus fruit cannot be included, the need for salads and carefully cooked

leafy vegetables and tomato (either raw or cooked) is increased. One serving of citrus fruit, grapefruit or orange, nearly meets the day's requirement of vitamin C.

Apricots, peaches, and to a lesser extent, prunes, have a place all their own among the fruits. They are effective in hemoglobin regeneration, quite out of proportion to their mineral content. For this reason, the inclusion of these fruits in the diet once a week or more is wise. A second fruit daily is highly desirable. Use fruits as a dessert, at least part of the time.

Meat. It is possible to have the diet adequate in protein if ample milk, cheese, and eggs are included, but for satiety value nothing replaces the occasional use of meat. To include meat daily greatly enhances the palatibility and the food value of the diet. Meat is an excellent source of protein, minerals, and the B vitamins. With the variety in cuts, combinations, and methods of cooking, no monotony need exist.

Fish and meat are essentially interchangeable (see Proteins, Chapter IV). The iodine content makes the use of salt-water fish, at least once weekly, desirable.

Liver is considered separately from meat because it is meat de luxe from the standpoint of nutrition. It has all the constituents present in other parts of the carcass, and in addition has a higher vitamin B potency, is a valuable source of vitamin A, and has no superior in any form as a blood-regenerating food. Liver revolutionized the treatment of anemia, and while it is rarely possible for a person to eat enough liver, as such, to control pernicious anemia, its concentrates are the most valuable form of medication in this disease, and certain amounts of liver in the diet are extremely important. Liver should be served weekly in the normal diet. There is no difference in nutritive value between calf, beef, lamb, and pork liver, but there is a difference in the palatability and in the cost. The milder the flavor (calf liver) the higher the cost. It is essential that the liver juices be preserved in preparing liver for the table. Soaking or parboiling to remove the strong taste also removes minerals and vitamins, and this practice should be avoided.

Eggs should be served daily if possible. The yolk contributes vitamin A in good amount, vitamin B_1, and is one of the few food sources of vitamin D. The yolk also contains lecithin, essential fatty acids, and iron. The white is pure albumen. If eggs cannot

be used daily, at least three a week should be consumed by the individual. Boiled, baked, scrambled, made into puddings, cakes, etc., they play their part, however they are used.

Fats contribute calories to the diet, but in the basic diet they are important also for their vitamin, cholesterol, lecithin, and essential fatty acid content. Animal fats contribute vitamin A. Butter, cream, and fish oils contribute vitamin D. The seed oils, such as cottonseed (Wesson) and corn oil (Mazola), furnish the unsaturated fatty acids, vitamin B_6 (pyridoxine), and pantothenic acid. Therefore, a generous serving of both butter and salad oil daily is important.

After the particular forms of food here mentioned have been included in the diet, other foods, according to fancy, may be included to contribute the additional calories. The foregoing basic diet will contribute about 1,000 calories.

Diets may be made more appealing by keeping in mind certain factors in the preparation. For example, the colors of foods should harmonize. A colorless meal can be colorless indeed as to taste, just as a clash of colors may detract from palatability. Cold foods should be served cold, and hot foods hot, and the temperature of the meal suited to the outside environment. No meal should consist of all soft foods or all chewy foods. A combination of crunchy and soft foods in the same meal makes the food more interesting. Monotony of texture should be avoided as much as monotony of color.

Foods bland in flavor are better if alternated with those having snap as to flavor. Variety will lend appeal and no one foodstuff should be predominant.

We have endless flavorings, spices, and garnishes (parsley is not the only one), and meals become attractive looking from this standpoint with little effort.

Concentrated foods are better coupled with bulky foods, if total bulk and calorie balance are to be maintained.

Do not serve the same food twice the same day. Dress the leftovers up differently for another day.

Except in extremely hot weather, it is well to plan a hot drink or hot dish for every meal, even hot biscuits or hot rolls, for the sake of variety.

Fresh vegetables, fruits, and fish served in season taste better and give added zest to meals when their particular season arrives.

TABLE 39

THE BASIC 7 FOOD LISTS

GROUP ONE		*GROUP TWO*	*GROUP THREE*	
Green Vegetables	*Yellow Vegetables*		*Vegetables*	*Fruits*
Asparagus, green	Carrots	Oranges	Potatoes	Apples
Beans, snap, green	Pumpkins	Orange juice	Sweet potatoes	Apricots
Beans, lima	Squash, winter, yellow	Grapefruit	Artichokes	Avocados
Broccoli	Sweet potatoes	Grapefruit juice	Beets	Bananas
Brussels sprouts		Lemons	Cabbage, white	Berries
Cabbage, green		Other citrus fruits	Cauliflower	Cherries
Chard		Tomatoes	Celery	Cranberries
Collards		Tomato juice	Corn, sweet	Currants
Endive, green		Cantaloups	Cucumbers	Dates
Escarole		Pineapples, raw	Eggplant	Figs
Kale		Strawberries, raw	Leeks	Grapes
Lettuce, leaf		Cabbage, raw	Lettuce, head	Peaches
Mustard greens		Greens, salad	Mushrooms	Pears
Okra		Peppers, green, raw	Onions	Persimmons
Peas, green		Turnips, raw	Parsnips	Pineapple, canned
Peppers, green and red			Radishes	Pineapple juice, canned
Spinach			Rutabagas	Plums
Turnip greens			Salsify (oyster plant)	Prunes
Wild greens			Sauerkraut	Raisins
Other greens, including salad greens			Squash, summer	Rhubarb
			Turnips	Watermelons
	Eat one or more servings daily. These foods may be raw, cooked, frozen or canned	Eat one or more servings daily. These are the high vitamin C foods	All other fruits and vegetables not in group 1 and 2. Eat two or more servings daily. These foods may be raw, cooked, frozen, canned, or dried	

Adjust the meal so that there is a preponderance of alkaline, rather than acid, ash. Rice as the "vegetable" with chicken and biscuit, with perhaps custard pie for dessert, would, of course, result in a predominance of acid. If potato replaced the rice, and fruit the dessert, the acidity would be replaced by alkalinity.

All peoples, regardless of race, creed, economic, or social status, or personal characteristics, require the same kind of food, for body needs do not change. But all these varying circumstances must be taken into consideration at times in planning the diet. Environment and state of health also exert modifying effects. With thought, it is usually possible to secure adequate food intake in any of these circumstances, but too frequently diets needlessly fail of their purpose. No diet will be long tolerated which departs radically from habits of years' stand-

TABLE 39—CONT'D

GROUP FOUR	*GROUP FIVE*		*GROUP SIX*	
Milk—all kinds Cheese Ice Cream Recommended milk allowances: Children—3 to 4 cups Adults—2 cups or more Pregnant women—1 quart, at least Nursing mothers—about 1½ quarts Calcium equivalent of 1 cup milk will be provided by cheese: ounces Cheddar-type 1 Cream-type 4 Cottage 12 Or by 2 to 3 large dips of ice cream	Beef Veal Lamb Mutton Pork (except bacon and fat back) Lunch meats (bologna, etc.) Variety meats (liver, heart, kidney, brains, tongue, sweetbreads) Game Poultry (chicken, duck, goose, turkey) Fish Shellfish Eat one serving daily, if possible, of meat, poultry, or fish Eat 4 or more eggs a week Eat two or more servings of beans, peas or nuts a week	Eggs Dried beans Dried peas Lentils Soybeans Soya flour and grits Peanuts Peanut butter Other nuts	*Breads* Whole-wheat Enriched Dark rye Rolls or biscuits made with whole-wheat or enriched flour Oatmeal bread *Crackers* Enriched Whole-grain Soya Eat some Group 6 foods every day	*Cereals* Whole-wheat Rolled oats Brown rice Converted rice Other cereals, if whole-grain or restored *Flours* Enriched Whole-wheat Other whole-grain Corn meal, whole-grain or enriched Grits, enriched
			GROUP SEVEN Butter, and vegetable oils Eat some daily	 Fortified margarine

In addition to the basic 7, eat any other foods you want.

ing, is difficult to obtain under existing living conditions, or under the economic limitations of the individual, or which may make him conspicuous. Any diet planned for the normal, the chronically ill, or the acutely ill person must be flexible enough to permit adjustment within the major food groups so that food familiar and appetizing to the individual may be utilized.

At the end of this book are listed several excellent publications invaluable to the food planner when she is faced with the many factors which arise to make necessary adjustments in the diet.

The "**Yardstick**" **of Good Nutrition**, also spoken of as "The Basic Seven" or "The Wheel of Good Eating," is a streamlined version of the recommendations of the Food and Nutrition Board.

This suggests that certain items be chosen each day from specific food groups. Such a choice assures adequacy of diet and conformation of the detailed standards (see Chapter XVI) as can be seen readily from perusal of the groupings which follow. Such an instrument serves as a means of improving dietary habits without confusing the lay public with scientific details. Details and reasons must be more slowly acquired.

TABLE 40

Schematic outline for a low cost diet, which would meet minimum requirements but which is not optimum:

Milk—1½ pints daily for each child and at least 1 cup daily for each adult. This may be partly used in preparation of one milk dish daily for the entire family.

Cereal—every breakfast and in some form besides bread a second time during the day. Wheat-germ, vitamin reinforced, reinforced or whole grain cereal to be used as much as possible.

Fruits—three times weekly.

Vegetables—two daily besides potato which may frequently be used twice in one day. One besides carrots, cabbage, or tomato weekly.

Tomato or citrus fruit—at least three times weekly for adults; daily if possible for children.

Raw, leafy vegetables—generously if the citrus fruit or tomato cannot be used—one daily.

Legumes—once or twice a week.

Cheese—once a week.

Fish—once a week.

Eggs—two to four weekly for children; at least two weekly for the adult.

Liver, heart, or kidney—once weekly.

A second meat—once or twice weekly.

Soups—alternate with solid foods for the light meal of the day.

Biscuit or muffins (homemade)—substitute for bread once or twice a week.

Cookies or cakes (homemade)—once a week. They need not be costly if ingredients are chosen with economy in mind. They add variety to the menu.

Cod-liver oil—as part of the diet.

Two different types of food at each meal.

Some general principles can well be kept in mind. It is possible, while still maintaining the schematic outline for adequate diet, to adjust it to different economic levels. For instance, cereals in bulk

TABLE 41
SAMPLE LOW-COST DIETARY
Committee on Food and Nutrition, National Research Council

Breakfast	*Lunch*	*Dinner*
Tomato juice	Baked navy beans	Pot roast and gravy
Oatmeal with top milk	Cabbage salad	Baked potatoes and oleo
Toast with butter or oleo with vitamin A	Bread with butter or oleo with vitamin A	Carrots
Coffee for adults	Prunes	Bread with butter or oleo with vitamin A
Milk for children	Milk	Gingerbread
		Tea or coffee for adults
		Milk for children

Approximate food value

FOODS	AMOUNT GRAMS	APPROXIMATE MEASURE	CALORIES	PROTEIN GRAMS	CALCIUM GRAMS	IRON MG.	VITAMIN A I.U.	THIAMINE (B_1) GAMMA*	RIBOFLAVIN GAMMA*	ASCORBIC ACID MG.
Milk	480	1 pint	336	15.8	.58	0.15	528	244	1000	6
Meat	100	¼ lb.	150	21.0	.01	3.00	50	120	225	—
Potatoes	350	3 medium	300	7.2	.05	3.66	144	432	162	12
Baked beans	200	1 cup	200	13.2	.09	4.00	110	235	130	—
Cabbage, raw	100	1 cup	25	1.1	.04	0.43	88	70	72	35
Carrots	100	½ cup	40	1.2	.04	0.64	2100	60	58	—
Tomato	200	⅝ cup	50	2.4	.02	0.80	2000	182	122	48
Prunes, stewed	200	⅝ cup	250	1.4	.03	1.88	990	120	132	—
Oleomargarine with vitamin A	66	5 tbsp.	500				2600			
Oatmeal, cooked	300	1¼ cup	200	8.0	.03	2.40	—	270	60	—
Bread, whole wheat or enriched	200	6 slices	500	19.0	.10	3.0	—	480	207	—
Ginger bread	75	large piece	200	3.5	.08	2.0	—	40	30	—
Sugar, jam			250							
Totals			3001	93.8	1.07	22.0	8602	2253* 2.25 mg.	2234* 2.23 mg.	101
compared with *Recommended Allowance*			3000	70.0	1.0	12.0	5000	1.5 mg.	2.0 mg.	75

*1 milligram (mg.) equals 1000 micrograms (gamma).

are less expensive than the packaged varieties. Cooking costs may be reduced by the use of a fireless cooker, by utilizing the top of a heating stove, or the ledge of the furnace. Lower-priced cuts of meat are as nutritious as the expensive cuts, except where bone content offsets the lower price paid. In general, cabbage, tomatoes, carrots, and potatoes are the cheapest vegetables, and there are none better. Seasonal buying is a factor here also. Fancy brands of canned goods offer no greater food value than cheaper brands. A knowledge of can sizes and brands often effects a saving. Canned or powdered milk may replace fluid milk, and skim milk may be substituted for whole milk (see Proteins, Chapter IV). As we have stated previously, legumes may replace in part milk-egg-meat protein. Cottage cheese is cheap and contributes valuable protein. Oleo and nut margarines, if reinforced with vitamin A, may replace butter and are much less costly.

Day-old bread instead of freshly baked offers a saving. The home baking of cakes and cookies, and the preparation of puddings in the home, rather than the use of packaged products, is usually less costly. Broken crackers, broken rice, etc., are cheaper than the whole products.

However, if the diet were forced to the monotonous level of whole grain cereals, whole milk, and raw cabbage, it would be surprisingly adequate if taken in sufficient amounts, as calculation of its content indicates. Not desirable, of course, but possible.

A **liberal diet** would contain more milk, eggs, meat, fresh vegetables and fruits, a salad daily, desserts, and less cereal. For such a diet one might follow the skeleton menu below:

Morning

Fruit
Choice of cereals
Egg, if desired
Toast, rolls, or muffins with butter
Coffee with sugar and cream

Noon

Hot dish, salad, soup, or sandwich
Crackers, rolls, or buns unless used in sandwich
Dessert
Glass of milk

Night

Tomato juice, fruit juice, or fruit cup
Meat or fish
10% vegetable
Potato
Salad
Dessert
Tea or coffee if desired

There is variety enough within the food groups so that the individual may have wide choice of the foods best suited to him economically or on any basis, whether he eats in the home or in the restaurant. He may prefer hearty foods, rather than attractive, palatable meals in which quality is the keynote. He may be a faddist or he may have pronounced likes and dislikes. He can still indulge in his tastes, keep within his budget, and maintain normal nutrition by observing the fundamental principles of diet planning.

The result of a recent Gallup poll of American eating habits indicates how few actually have a diet which is scientifically considered that conducive to optimum health. The results of this poll showed—and we quote:

Essential Foods	*How Americans Are Eating*
1. Green or yellow vegetables	23% had none
2. Citrus fruit, tomato or raw greens	46% had none
3. Other fruits or vegetables	9% had none
4. Milk or milk products	32% had none
5. Meat, fish or poultry	9% had none
6. Eggs	40% had none
7. Cereal or bread	4% had none
8. Butter or other fats	22% had none

The relation of this survey to another survey on illness may be significant. This second survey showed that 16 per cent of the total population or about 21,000,000 persons in the United States were suffering from the common cold.

Recent reports of the number of man hours lost a year due to various illnesses are tremendously large, estimated at about 1,500,000.

Fundamental knowledge of the art and science of nutrition enables us to evaluate foods and to find the loopholes in many currently popular "diets."

When diet needs adjustment other than to environment, let it be made carefully and with an understanding of the metabolic dysfunction, and with due consideration of the patient as a person with rights and privileges. Insofar as these are compatible with his nutritional welfare, they should receive attention.

In many diseases diet does not need adjustment (see specific discussions), but it must always be remembered that first and foremost *the individual has a body which must be maintained in as nearly perfect a state of nutrition as is possible, and second, that due to some abnormality, certain foods may not be used in normal*

fashion. Only such foods as require alteration in kind or amount should be changed, and after such a change is made, there should be assurance that a dietary deficiency will not result which may be as serious as the disease the diet is designed to alleviate.

Dr. Alvarez aptly expressed the need for sound dietetic information when he said that the pressure of opinion produced by the campaign for vitamins, roughage, green and raw foods, was so great that it could be withstood only by a determined and thoughtful person who was well supplied with facts.

TABLE 42

The data here summarized from earlier chapters may be used for approximate numerical calculation as follows:

A man 6 feet tall 72 inches
40 cal. inch
2880 calories

Roughly 3000 calories.
If division between food stuffs is 15 per cent protein, 35 per cent fat, 50 per cent carbohydrate, the calculation would continue

3000 calories
15 per cent
$4\sqrt{450.00}$ protein calories
112 approx. gm. protein (each gm. yields approx. 4 cal.)

3000 calories
35 per cent
$9\sqrt{1050.00}$ fat calories
117 approx. gm. fat (each gm. yields approx. 9 cal.)

3000 calories
50 per cent
$4\sqrt{1500.00}$ carbohydrate calories
375 approx. gm. carbohydrate (each gm. yields approx. 4 cal.)

The diet prescription (℞) would then read:

3000 calories, 112 gm. P, 117 gm. F, 375 gm. C.

It can be seen from these values that in the normal diet there is a *rough* ratio between the nutrients—approximately 1 gm. P: 1 gm. F: 3.5 gm. C. These figures, if kept in mind, make it possible to discern whether a therapeutic diet is high or low in any of the constituents by reading the prescription. Furthermore, and very roughly, one can remember that for the adult man the value is not far from 100 gm. for protein—an easy whole number to remember.

The protein levels based on 3000 calorie intake are roughly as follows:

7%	protein calories	50 gm. protein—low level
10%	protein calories	75 gm. protein—average level
15%	protein calories	100 gm. protein—generous level
20%	protein calories	150 gm. protein—high level
25%	protein calories	200 gm. protein—very high level

CHAPTER XVIII

WEIGHT CONTROL

Whenever energy expenditure ceases to balance energy consumption, body tissues reflect this imbalance. In other words, whenever ingested energy in the form of food exceeds that expended, the excess is stored as body fat and weight is gained. Conversely, when expenditure is greater than can be supplied by the food eaten, the additional energy necessary to carry on body activities is derived from the body tissues themselves, and weight is lost. On this basis diets for weight adjustments are prepared.

The discrepancy between intake and outgo is not always due to a perverted appetite. It may be dependent on a change in metabolic rate which is not accompanied by compensating appetite change. Such discrepancy may be due to overglandular or underglandular activity, to changes in body temperature, to the activity program, or to illness.

In general, however, abnormality in weight is due to dietary indiscretion, and increase or decrease can be brought about by careful adherence to a prescribed program. Largely due to the scientific findings of insurance companies, there has been an increased interest in weight control in recent years, other than might be instigated by the decrees of fashion. Insurance companies have shown that wide departure in weight from the average value for individuals under similar conditions has its effect on life ex-

TABLE 43

A simple calculation of weight for height has found general usage: For 60 inches in height, allow 100, 105, 110 pounds for the slender type women (or girls), the average type, or the stocky type, respectively. The figures for men and boys are 110, 115, 120. For every inch which the individual is above or below the 60 inches, add or subtract five pounds per inch. For example,

6 foot man stocky build
- 72 inches minus 60 inches equals 12 inches × 5 equals 60 pounds
- 120 pounds (for 60 inches) plus 60 pounds for additional 12 inches equals roughly 180 pounds

or 54 inch girl slender build
- 60 minus 54 equals 6 × 5 or 30 pounds
- 100 minus 30 equals approximately 70 pounds

TABLE 44

DESIRABLE WEIGHTS FOR MEN AND WOMEN OF AGES 25 AND OVER

(These tables are based on numerous Medico-Actuarial studies of hundreds of thousands of insured men and women.)

MEN WEIGHT IN POUNDS ACCORDING TO FRAME (AS ORDINARILY DRESSED)					WOMEN WEIGHT IN POUNDS ACCORDING TO FRAME (AS ORDINARILY DRESSED)				
Height (with shoes on) Feet	Inches	Small Frame	Medium Frame	Large Frame	Height (with shoes on) Feet	Inches	Small Frame	Medium Frame	Large Frame
5	2	116-125	124-133	131-142	4	11	104-111	110-118	117-127
5	3	119-128	127-136	133-144	5	0	105-113	112-120	119-129
5	4	122-132	130-140	137-149	5	1	107-115	114-122	121-131
5	5	126-136	134-144	141-153	5	2	110-118	117-125	124-135
5	6	129-139	137-147	145-157	5	3	113-121	120-128	127-138
5	7	133-143	141-151	149-162	5	4	116-125	124-132	131-142
5	8	136-147	145-156	153-166	5	5	119-128	127-135	133-145
5	9	140-151	149-160	157-170	5	6	123-132	130-140	138-150
5	10	144-155	153-164	161-175	5	7	126-136	134-144	142-154
5	11	148-159	157-168	165-180	5	8	129-139	137-147	145-158
6	0	152-164	161-173	169-185	5	9	133-143	141-151	149-162
6	1	157-169	166-178	174-190	5	10	136-147	145-155	152-166
6	2	163-175	171-184	179-196	5	11	139-150	148-158	155-169
6	3	168-180	176-189	184-202					

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pectancy. Before the age of 30 to be slightly above the average or normal weight, is an excellent investment in health. In the thirties it is best to be essentially average in weight, and above 40 to hold the weight somewhat below that level. While racial and familial factors influence weight, it is possible for the normal individual to stay within a range which varies not more than ±15 per cent from the mean.

If energy requirement is calculated to be the theoretical amount for the individual under normal conditions of weight for height and age, rather than for actual weight at the time, then body weight must necessarily approach this normal level. However, if weight is excessive, such a rapid change in dietary habits may not be possible or practicable. Sudden weight reduction may leave muscles, organs, and tissues unsupported and weakened by lack of fat pads.

The caloric requirement as calculated from the actual height-weight or surface area figures may be increased or decreased by increments of 10 to 20 per cent. Or again, weight may be slowly altered by adjusting the caloric intake 500 calories above or below the existing level. For example, if one decreases the intake by 500 calories daily, the resulting 3,500 calories per week will be equivalent to approximately one pound of body fat ("fat" is approximately ⅘ fat and ⅕ water), a sensible and safe reduction of weight of one pound weekly. *Weight loss should never exceed two pounds per week.*

Height-weight tables are given in Table 44. From them it is possible to ascertain approximately what the relationship should be.

Until recently, height-weight tables indicated weight change with the years. Today the consensus is that weight increase should not take place after the age of 30.

The Obese Individual

Overweight is the term applied to individuals who are 10 to 20 per cent above the accepted average. The term obesity is used when the excess weight exceeds 20 per cent. This amount of excess weight should cause concern.

Normal individuals with normal eating habits unconsciously adjust caloric intake to caloric expenditure to an astonishing

degree. This is surprising when one considers that approximately 50 tons of food are eaten in a lifetime—700 pounds for every pound of flesh. It would seem as though this relatively constant weight maintenance was not mere chance. It does appear probable that there is a regulating mechanism for weight control just as there is for other metabolic processes. To date, however, none has been proved.

There are two general types of obesity: exogenous or alimentary (as the name indicates, this deals with factors outside the body), and endogenous which has to do with body dysfunction. (See discussion under Endocrines, Chapter IX.) Probably 90 per cent of all obesity is due to simple maladjustment between food intake and energy expenditure. The other 10 per cent are complicated by additional factors.

For the 90 per cent who can adjust their weight if a planned program is followed, the cause for overweight can be roughly classified as:

1. Specific overeating—too hearty an appetite.
2. A lowered metabolic rate as in advancing years or a curtailment of activity (car riding, etc.) without the corresponding decrease in food intake.
3. Family eating habits—or overeating. The home with the "famous" cook.
4. "Seconds."
5. The keen enjoyment of extras which are eaten at the end of a meal which in itself was sufficient.
6. Preference for foods of high caloric value.
7. Between-meal snacks.

There is but one method of adjustment—a revised food program—a sensible adjustment in eating habits.

Radical changes in eating habits, or the ingestion of diets which in any way differ markedly from those ordinarily followed, are difficult to maintain over any long period. Each individual's diet must be considered separately. Furthermore, it must be possible to obtain such a diet from the standpoint of the economic, racial, and environmental conditions under which the individual lives. The diet must satisfy (have satiety value), and it must not make the dieter either unduly conspicuous or self-conscious. And lastly,

in most instances the diet must be such that the individual will be maintained in a state of health and strength compatible with his normal occupational activity.

A common fallacy in weight reduction is to reduce carbohydrate to too low a level. Some carbohydrate is necessary to permit the most effective utilization of the fat in the diet, as well as that which is to be drawn from the body stores, since these stores will be drawn upon to make up the difference between the calories expended and ingested, exactly as though they were food fat. A ketosis will develop if fat alone is used to supply energy. The body's ability to oxidize fat completely to carbon dioxide and water is limited (60 per cent is the approximate upper limit). The remnants of unburned fat—the ketone bodies—pile up in the blood. Carbohydrate must assume part of the burden. For this reason, the inclusion of adequate amounts of fruits and vegetables is necessary. Intake of "sweets" and large amounts of cereals or cereal products, or 20 per cent vegetables is, however, undesirable. The food fat, on the other hand, should be reduced to a low level. These two adjustments will undoubtedly result in the need for an increased protein intake which may in itself be of value because of the stimulating effect (S.D.A.; see Chapter II) of protein upon the metabolic rate.

No matter how important weight reduction may be, or how low a caloric intake is desired, there is a minimum below which one should never go. The essentially dietary factors remain the same in sickness and in health. Therefore, a schematic outline should be followed. An outline such as the following one will yield approximately 1,200 calories (82 gm. of protein, 42 gm. of fat, and 125 gm. of carbohydrate).

The diet should include the following foods each day:

1. Milk—one and one-half pints of skim milk.
2. Cereals in small amounts: Puffed Wheat or Puffed Rice, Cornflakes, Force, Rice Krispies, Crackles with milk. No sugar. Not more than 2 slices of white, whole wheat, graham, or rye bread.
3. Fruits—three servings, at least one of which should be uncooked, plus a citrus fruit or berries. All fresh fruits in season. No sugar.

4. Vegetables in large quantities. They are the fillers of the reducing diet. At least 2 cupfuls of any green or salad vegetable, such as asparagus, beet greens, broccoli, Brussels sprouts, cabbage, cauliflower, celery, cucumber, dandelion green, escarole, egg plant, kohlrabi, lettuce, radish, sauerkraut, Swiss chard, spinach, summer squash, young green string beans, tomatoes, and tomato juice.

   The more starchy vegetables, such as the following, should be eaten in moderation, approximately 1 cupful per day—beets, carrots, celery root, onions, winter squash, turnips.

   The following 20 per cent vegetables should be omitted—beans of all kind (except string beans) corn, peas, lentils, and potatoes
5. Meat and fish—a large serving daily. Only lean meats which have no visible fat should be used. Salt pork, bacon, and fried meat should be omitted. Light-colored fish, such as haddock, cod, halibut, and perch are used in preference to the dark fish, such as tuna, salmon, mackerel, and sardines. The latter contain large quantities of fat. If used at all, boiling water should be poured over the broken pieces until the oil is completely removed.
6. Eggs—three or four each week, 1 per day is preferable—in any way except fried.
7. Cheese—generous amounts of cottage cheese. All other kinds should be omitted from the diet. The cottage cheese may be variously flavored by the addition of chopped chives, pickles, onions, tomato or pineapple juice, green peppers, etc.
8. Fats in very small amounts—not more than 2 tablespoonfuls should be included each day. Oil, cream, or meat drippings on bread or vegetables should be omitted. Salads should be eaten without dressing, or with only a small amount or just vinegar, pepper, and salt, fruit juice, or mayonnaise made with mineral oil. (See discussion, page 231.)

The foods suggested may be used as follows:

Morning: cereal with skim milk, glass of skim milk, piece of fruit, piece of buttered toast, clear tea or coffee.

Noon or night: meat, 2 vegetables, glass of skim milk, simple dessert, or piece of fruit or mixture of fruits.

Night or noon: salad, bread and butter, glass of skim milk, piece of fruit.

Clear soup, bouillon, or beef tea, tea and coffee may be used as desired. They have no food value. Likewise "diabetic" gelatin is palatable and an excellent filler.

Some of the milk and egg may be made into custard, or the breakfast cereal may be omitted, and rice or tapioca pudding prepared. Celery, watercress, chives, radish, and peppers used as garnish need not be counted.

The day's bread may be used in a sandwich with meat, cottage cheese, lettuce, cabbage, etc., if the noon meal is the lighter meal. Four very thin slices of home-cut bread will equal two slices of "ready sliced" bread. It seems like more bread. Made into Melba toast, the need for butter is obviated, due to the altered flavor.

As the vegetable intake increases, care must be exercised not to add unwanted calories by the use of salad dressings. A "reducer" mayonnaise is frequently used. This may seem to be the logical procedure inasmuch as in these dressings, mineral oil, which is not utilized by the body (therefore yielding no calories), replaces the usual salad oil. However, mineral oil, like other oils, is capable of absorbing fat-soluble vitamins. If such action takes place, the vitamins remain in the oil and leave the body by way of the stool. This is specifically true of carotene (provitamin A). Mineral oil used for laxative purposes has this same effect.

When a lower caloric intake is desired, the following diet outline may be used, but *only when medical supervision is available:*

750 calorie level: 1½ pints of skim milk, 2-3 cups of 5 per cent vegetable, 2 ounces of meat, 1 egg, 3 oranges, ½ cup of cottage cheese.

1,000 calorie level: The above diet and in addition—1 small serving of cereal, ½ cup 10 per cent vegetable, 1 piece of sliced bread, 1 ounce of meat or fish.

Or one may prefer to: Gradually use smaller size portions of food. Change to the diet as outlined at once, and then gradually decrease the size of the serving until the amount indicated is reached. It may be more satisfactory to do this slowly and faithfully than to make a sudden change by decreasing the diet to the point of extreme hunger.

Oil salad dressing, candy, pies, cakes, cookies, corn, peanut butter, nuts, jellies, jams, fat meats, lima beans, fried foods, spaghetti, macaroni, crackers, dried peas, beans, or lentils, potato should be avoided as should between-meal snacks.

For an individual whose caloric requirement is 2,000, a reduction below 750 calories should never be undertaken, and even this low level only when drastic reduction is imperative. In general, it is distinctly unsafe to reduce caloric intake to a point below one-half the required calories, because such adjustment of food essentials is extremely difficult. To repeat, reduction should be medically supervised.

At levels of 1,200 calories, or less, commercial vitamins must be administered to prevent deficiencies in the vitamin B group and the fat-soluble vitamins.

Exercise in order to maintain or re-establish normal muscle tone is important; not strenuous exercise, but well-planned exercises and exercise. It is said that the difference between a good figure and a lumpy one is the muscular development. Fat loss must be replaced by well-toned muscles for organ support. Sudden withdrawal of fat pads is dangerous.

It has been calculated that from the first to the one hundred third floor of the Empire State Building there are 2,240 steps; to climb this would require 2,000 calories, which would correspond to about ½ pound body fat. To lay 14,731 bricks would cost 4,000 calories. Obviously, exercise alone is a foolish attempt at weight loss aside from the fact that strenuous exercise is usually accompanied by an increase in appetite. The sudden weight loss in violent exercise is due largely to water.

In *The Cornell Bulletin* on "How to Control Your Weight," Dr. Hazel Hauck includes a table to indicate the energy value of some common snacks in terms of the miles needed to be walked in order to use up the energy which they provide.

Drugs are frequently used these last several years as a means of appetite curtailment. In some instances under a physician's direction these may be justified. They may have an unwanted effect on blood elevation and *should never be self-prescribed.* The use of thyroid without supervision is also dangerous.

In those individuals whose obesity results from underactivity of the thyroid gland, or hypothyroidism, the addition of a thyroid

TABLE 45

THE NIBBLE	APPROXIMATE MILEAGE TO "WALK IT OFF"
1 caramel	0.7
1-inch cube of chocolate fudge	1.3
1 jelly bean (who can stop with one?)	0.1
1½ ounces milk chocolate (a 5 cent bar)	3.3
1 graham cracker	0.7
1 cup ginger ale or other soft drink	1.2-2
1 cup beer	1.2-2
1 ice-cream cone (5 cents)	1.5-1.7
1 ice-cream sundae	5-7
1 doughnut	2.8
1 salted peanut	0.1
1 date	0.3-0.5
1 cup popcorn (without butter, though you probably don't eat it that way)	1.0
1 tablespoon butter (a very modest allowance for the popcorn)	1.5
1 sliced ham sandwich	2.5-3.5
1 piece mince pie (4½ inches at circumference)	6.5
1 piece chocolate loaf cake (3 × 3 × 2-3 inches)	1.5

See Table 105 for caloric value of foods.

preparation to counteract the glandular deficiency will usually result in satisfactory increase in metabolic rate and corresponding weight reduction. The activity of the thyroid gland can readily be ascertained through determination of the basal metabolic rate (see Metabolism, Chapter II). Roughly, each grain of thyroid (U.S.P.) will increase the basal metabolic rate by 10 per cent. *Thyroid and other drugs should be taken only when adequate medical supervision is available.* Unfortunately, many so-called obesity cures on the market today contain such drugs and their use should be avoided. Also available are vitamin-mineral pills with accompanying instructions which are planned to produce a low calorie diet—these, without the "famed" product, would bring about weight loss if instructions were faithfully followed.

McLester outlines the disadvantages of obesity as fourfold. First, there may be a lack of balance between the body mass and the heart strength, an undesirable condition even when the integrity of the heart is unimpaired. Second, the heart may be the seat of abnormal fat deposits, on the surface and between the muscle bundles. This condition naturally decreases muscular efficiency. Third, accumulations of fat in the abdomen may limit free movement of the diaphragm and in turn limit the free movement of the heart. Fourth, arteriosclerosis, which frequently ac-

companies obesity, may involve the coronary artery which supplies the blood to the heart muscles.

Quoting from the Metropolitan Life Insurance Company's notes on "Girth and Death" it is indicated that:

"The longer the belt line, the shorter the life line. Life insurance studies have shown repeatedly that body girth and length of life vary inversely with each other. This observation is one of the most fundamental and most valuable contributions of life insurance statistics to public health. It deserves increased emphasis today because serious attention to the problem of overweight affords one of the chief hopes of increasing the average length of life by reducing the mortality rate from the important diseases of middle and later life against which the least progress has been made.

"Overweight is distinctly detrimental to health and tends to shorten life. The most recent insurance study shows that distinctly obese men, that is, those 35 per cent or more above average weight, have a mortality over 1½ times that of average-weight men."

In the last several years articles have appeared suggesting that psychological factors may be involved in obesity—that food serves as a solace for some lack in their lives. As Gill expresses it in her discussion of "The Role of Personality and Environmental Factors in Obesity": "In studying the obese person one must realize that food is more than an organic necessity to him; in all probability it constitutes his chief source of satisfaction for a multitude of interests." This is an excellent example of the need for more psycho-dietetics.

The Underweight Individual

On the opposite side of the picture from the obese individual is the malnourished or underweight person, who due to dietary habits, activity, hyperglandular secretion, chronic illness, acute illness, or abnormality in food utilization (see Table 99) is below normal weight for his height and age. In many of these cases diet adjustment requires even greater ingenuity than for the obese person. Protein and caloric intake must be liberal and must exceed the daily needs in order that depleted stores may be restocked.

Fats in the form of cream, egg yolk, salad dressing, cream cheese, etc., are concentrated foods and excellent "padding." However, excessive amounts may have the reverse effect through the prolongation of the time of digestion and the resultant decrease in appetite (see Chapter VII).

Milk may be padded with powdered whole milk, skim, or malted milk in such a manner as to double or triple its concentration. Many flavors are available, which prevents monotony. Such preparations at Cal-C-Tose, Betene, Ovaltine, Meritene, etc., serve the purpose of adding extra food value and variety. Gelatin may be dissolved in fruit juices if drunk immediately. Eggs may be concealed in a variety of foods.

Cereals, starchy vegetables, and breadstuffs are concentrated carbohydrates and are excellent carriers of fats (butter, cream, peanut butter).

If weight is to be increased, the caloric intake must contain from 25 to 50 per cent more calories than the normal requirement of the individual. As in weight reduction, a gradual increase may be much more effective than a sudden change in dietary habits.

Malnutrition may be a dominant factor in many diseases and may be a matter of grave importance. The physical surroundings, attractiveness and palatability of the food, and the mental attitude of the patient usually require special consideration. Small and more frequent feedings may be desirable (see Chapter XXVII).

It is possible to plan two diets which, to the casual eye would be nearly identical as to ingredients and bulk. However, twice as many calories may be included in one of them. The difference lies only in the concentration of the foods themselves. Using the outline for the normal diet, the malnourished and the obese could be served the meals suggested in Table 46. Both would be satisfied, and neither would be conscious of caloric adjustment, and with that psychologic factor eliminated, the diet would be more easily followed. A diet which gives a feeling of hunger or of fullness or which psychologically is not satisfying will not be followed willingly.

Similar adjustment may be made for a dinner meal. The meat may be the same, but for the obese person the potato should be omitted, and a second generous serving of a leafy vegetable should replace it. Potato with butter or cream can be made to provide

TABLE 46

DIET OUTLINE

		BREAKFAST			
Malnourished			*Obcse*		
		Calories			Calories
Stewed figs		200	1 orange		100
Rolled oats cooked in milk		150	Puffed rice		50
2 tsp. sugar		20	2 tsp. sugar		20
⅓ c. cream		125	⅓ c. milk		50
2 thin slices toast		100	1 thick slice toast		100
butter for 2 slices		100	butter for 1 toast		50
Coffee—sugar and heavy cream		120	Coffee—clear		
		815			370
		LUNCH			
Malnourished			*Obese*		
		Calories			Calories
Cream soup		100	Clear soup		20
5 crackers		100	1 slice melba toast		50
Fruit salad			Fruit salad		
little lettuce			much lettuce	20	
1 banana	100		½ grapefruit	100	
2 tbs. mayonnaise	200	400	2 tbs. mineral oil		130
chopped peanuts	100		mayonnaise	10	
Bread and butter			Bread and butter		
2 thin slices bread	100	200	1 thick slice bread	100	150
butter for same	100		butter for same	50	
		800			350

several hundred calories. The salad adjustment could be similar to the one made at lunch, and bread and butter should be served only to the underweight or the nonreducer. A fruit dessert for one and a high caloric dessert for the other could make another 200 calories' difference, and so on.

Frequently small between-meal "snacks" of fruit, fruit juice, milk, or milk drink is of distinct value. Its effect on the next meal, however, must be considered, also the practicability of obtaining the extra meals.

As such dietary adjustments are made, it must be remembered that activity plays a large part in determining the caloric need. Due consideration must be given to this element, and an attempt must be made to have the activities supplement the caloric change, rather than counteract it.

Review Questions

If an adult is in good health, what is the cause of a gain in weight?

What two methods may be used to keep the weight at a figure considered normal for one's age and height?

What variation from the mean may be allowed and still have the weight called normal?

In a reducing program what is a safe amount of weight to lose weekly?

Of the oxidizable food nutrients, which one should be limited to the greatest extent?

Should carbohydrates be omitted? Explain.

Should drastic reduction be self-instituted?

What foods may be eaten by the underweight individual which are forbidden for the obese?

CHAPTER XIX

EVALUATION OF NUTRITIONAL STATUS

For many years weight for height and age has been considered the measure of the nutritional status. It is, of course, a rough measurement, but as nutrition has developed into one of the major sciences, it is realized that other standards must be developed and applied. Just what should be used as criteria is a current question.

Obviously, the state of nutrition will be reflected in various physiologic findings, such as the relationship between the blood and urinary findings and the values considered to be "normal," muscular development, heart action, x-ray picture of chest, teeth, and other findings which might be revealed by careful physical examination. Today we have methods whereby the chemical values for the constituents—protein, vitamins, minerals, etc.—can be determined for the body fluids, and standards against which the found values may be checked. Of course the weight, as compared to average values, continues to be of value as one of the measurements.

The "nutritional history" should also include a summary of the health and food habits of the individual, and any symptoms which might be related to food should be given careful evaluation. Deficiency symptoms or manifestations of allergy may be revealed.

Various means of checking one's own adherence to general health and food habits have been suggested. The Personal Health Standard and Scale prepared by Dr. Wood* (copyright—Teachers College, Columbia University) is reproduced here with Dr. Wood's permission. Dr. Wood states in the preface to Table 47:

"There are three ideals or standards of personal health for the individual:

1. The ideal that one has of health, the perfect health that one imagines and would like to have. This is never wholly attainable.
2. The health that one actually has. This is often far below the possible and the practicable for the individual.

*This folder, priced at 10 cents per copy, may be obtained from the Bureau of Publications, Teachers College, Columbia University.

TABLE 47

WOOD'S PERSONAL HEALTH SCALE

Personal health and efficiency involve certain subjective and objective factors and evidences.

I. Subjective Factors and Evidences of Health				
a. Enjoyment and zest in work and play	1	---	---	---
b. Feeling of being rested and refreshed in morning and not more than wholesomely tired at bedtime	1	---	---	---
c. General attitude of cheerfulness and confidence in relation to life and freedom from persistent worry and anxiety	1	---	---	---
d. Good appetite and relish for food	1	---	---	---
e. Freedom from regularly recurring or persisting physical pain and discomfort	1	---	---	---
f. Ability to work with comfort and satisfaction 8 hours a day, five and a half or six days in the week (44-48 hours a week)	1	---	---	---
II. Objective Factors and Evidences of Health				
A. Hygienic Program				
1. Diet				
At least one cup of milk daily	2	---	---	---
At least three large servings of greens (cooked or uncooked) in a week	2	---	---	---
Fresh fruit once a day	1	---	---	---
Some vegetable other than potatoes every day	2	---	---	---
Some food necessitating mastication at every meal	1	---	---	---
Eating no food between meals	2	---	---	---
Eating sweets, if at all, only at end of a meal	2	---	---	-
Drinking at least four glasses of water daily	2	---	---	---
Eating three regular meals daily	1	---	---	---
2. Devoting ½ to 1 hour daily to vigorous physical exercise outdoors, in gymnasium, or swimming pool (at least three hours' exercise a week outdoors). Exercise should be vigorous enough to cause deep breathing	3	---	---	---
3. Daily tonic bath and skin friction of type suitable for the individual	2	---	---	---
4. Brushing teeth at least twice daily in approved way	2	---	---	---
5. At least one satisfactory bowel movement daily, with regular attention to this function	3	---	---	---
6. Giving 8 to 9 hours in bed, and to sleep, daily	3	---	---	---
7. Lying down and resting 10 to 20 minutes between 11 A.M. and 2 P.M. each working day	1	---	---	---
8. Devoting 1 to 2 hours daily (in addition to daily exercise) to social recreation or recreative reading, or other recreative occupation	3	---	---	---
9. Keeping one full day each week for rest from regular work	3	---	---	

TABLE 47—CONT'D

10. Using at least two evenings or afternoons a week in addition to the seventh day for non-professional activity. (Occasional use of one or both of these evening or half-day periods for professional activity might be justified in an emergency.)	3	---	---	---
11. Dressing hygienically				
Clothing protecting against sudden changes in temperature	2	---	---	---
Shoes sensible in shape, guarding against marked changes in height of heels	2	---	---	---
12. Keeping weight within standard range for health, not more than 10% below nor 15% above standard for age and height, considering standard at 30 best standard for later ages	3	---	---	---
B. Freedom from remediable health handicaps and defects, including:				
1. Heart defects	3	---	---	---
2. Thyroid defects	3	---	---	---
3. Lung defects	3	---	---	---
4. Defective posture	3	---	---	---
5. Defective teeth	3	---	---	---
6. Eye defects	3	---	---	---
7. Defects of ears and hearing	3	---	---	---
8. Diseased tonsils	3	---	---	---
9. Defective nutrition	3	---	---	---
10. Skin disorders	3	---	---	---
11. Weak arches	3	---	---	---
12. Visceroptosis	4	---	---	---
13. Muscles undeveloped	3	---	---	---
C. Freedom from susceptibility to those diseases for which specific immunity is practically obtainable by vaccination—smallpox, typhoid, diphtheria	3	---	---	---
D. Freedom from susceptibility to those infections (e.g., colds) which result from unhygienic habits of living and remediable health handicaps	3	---	---	---
E. Freedom from metabolic errors (evidenced by urinalysis) and other less obvious defects which are revealed only by regular, thorough, physical examination	3	---	---	---
	100			

3. The health that one might have with the knowledge, appreciation, and realization of health that are reasonably available for the individual.

A personal health survey or inventory should show the relation of one's health to an optimum standard of health for one's type, age, occupation, etc.

A scale for measuring and recording personal health should give primary prominence and emphasis to the health progress one makes in lessening the distance from one's actual to one's attainable health.

The diet rating scale below, Table 48, is suggested for use by mature, responsible *adults*, who may rate themselves on some items,

TABLE 48

Name———— Address———— Date————
Unit No.———— Age———— Ht.———— Wt.————
Diagnosis

FOOD*	SERVINGS PER DAY FOR OPTIMUM NUTRITION	POINT VALUE	OPTIMUM SCORE	THIS SCORE
Vegetables Green, leafy or yellow spinach, chard, carrots	2 servings ½ c. each	10 for raw 6 for cooked	16	
Fruits or raw "green" salad	1 serving ½ c. or whole fruit equivalent	10 for citrus 6 for cooked 10 for salad	10	
Other vegetables or other fruits	2 servings ½ c. each or whole fruit equivalent	6 each	12	
Milk and milk products 1 oz. cheese may be substituted for one ½ pt. milk	1 pint	10 for each ½ pint	20	
Meat, fish, poultry or egg or alternative, as dried beans, peas, nuts, or peanut butter (not more than twice in week)	1 serving (3 oz.) or 2 eggs . ¾ c. serving	12 for meat 6 for egg 6 for alt.	18	
Whole grain or enriched bread or cereal	2 servings ½ c. cereal 1 slice bread	7 for each	14	
Butter or reinforced margarine	2 squares 1 × 1 × ¼″	5 for each	10	
LIKES				
DISLIKES				

Between-meal snacks, if any.
Are you allergic to any food?
Do you take vitamin pills?
Was a meal omitted? If so, subtract 10 points.
Remarks:

History taken by————
Service or Division————

*See details for grouping in Chapter XVII.

EATING HABITS PREVIOUS TO PRESENT ILLNESS

How has your appetite been?
Are you a hearty, moderate, or small eater?
Are your meals taken at regular times?
Do you eat a substantial breakfast?
Do you eat a substantial lunch?
What is eaten and drunk between meals?
Do you take extremely hot foods? Cold? Highly spiced?
How long do you spend eating breakfast? Noon meal? Night?
Are you a candy eater? How often? How much?
Are you fond of rich foods such as pies, rich cake, pastries, etc? How often do you have them?
Do you take an alcoholic drink before meals? How often? At other times?
Do you smoke immediately before eating? During meals?
What do you smoke? How much during the day?
Do you chew tobacco? How much during the day?
Do you drink water with meals? Between meals? Total glasses for day.
How much coffee do you drink during the day? How much tea?
How many hours' rest do you average nightly?
Do you rest either before or after any meal or at any time during the day?
Do you take cathartics? What? How often?
Do you have "indigestion"? How long have you had it?
What home remedy do you take?
In what condition are your teeth?
Have you ever been on a special diet or followed a diet plan previous to this illness?
What? How long?

and who in other items would be rated by a physician or some other health examiner.

By using the preceding diet history sheet, worked out by one of us and used in connection with a research problem, it was found possible to obtain an allover picture of the dietary habits in approximately 15 minutes.

In using such a score card more than "optimum" point value for any group should not be allowed even though more than the indicated amount is eaten. The additional intake should be recorded inasmuch as it might actually have compensating effect. If original credit is given, however, it might nullify the effect of serious omissions.

If one agrees, and who will not, that "today the word nutrition means more than eating; it refers to the entire development and well-being of the body," our approach to the subject must be

altered. In considering the all-over picture, again a wheel gives a graphic illustration. The hub of the wheel is food, but for good nutrition, for good functioning ability, there must be firm spokes. Spokes of good health habits, self-confidence, tolerance, alertness of mind and body, enjoyment of job and fellow men, absence of physical defects, rest, exercise, relaxation, etc., are factors which make the wheel run smoothly along the road of health, happiness, and efficiency.

A yearly health examination, of course, is advisable for all adults and children—an examination which will also include a careful inspection of the eyes. The eye reveals disturbances and deficiencies in other parts of the body, thereby becoming an important diagnostic organ.

In 1942 an excellent summary of clinical criteria of early deficiency disease symptoms in human beings appeared in the February and March issues of the *Journal of the American Medical Association.* The data were adapted for the "Edition of Nutritional Charts" compiled by the H. J. Heinz Company. We reproduce these outlines by permission.

TABLE 49

CLINICAL CRITERIA OF EARLY DEFICIENCY DISEASE SYMPTOMS IN HUMAN BEINGS

SYMPTOMS	PHYSICAL SIGNS
Infants and Children	
1. Lack of appetite (L)	1. Lack of subcutaneous fat (N)
2. Failure to eat adequate breakfast (L)	2. Wrinkling of skin on light stroking (N)
3. Failure to gain steadily in weight (L)	3. Poor muscle tone (D)
4. Late period of sitting, standing, and walking (N)	4. Pallor (N)
5. Aversion to normal play (L)	5. Rough skin (toad skin) (N)
6. Chronic diarrhea (L)	6. Hemorrhage of newborn (K) (D)
7. Inability to sit (L)	7. Bad posture (L)
8. Pain on sitting and standing (L)	8. Nasal blackheads and whiteheads (N)
9. Poor sleeping habits (L)	9. Sores at angles of mouth, cheilosis (L)
10. Backwardness in school (L)	10. Rapid heart (N)
11. Repeated respiratory infections (L)	11. Red tongue (D)
12. Abnormal intolerance of light, photophobia (L)	12. Square head, wrists enlarged, rib beading (N)
13. Abnormal discharge of tears (L)	13. Vincent's angina, thrush (D)
	14. Serious dental abnormalities (N)
	15. Corneal and conjunctival changes—slit lamp (D)

TABLE 49—CONT'D

SYMPTOMS	PHYSICAL SIGNS
Adolescence and Adults	
1. Lack of appetite (L)	1. Nasolabial sebaceous plugs (N)
2. Lassitude and chronic fatigue (L)	2. Sores at corners of mouth, cheilosis (L)
3. Loss of weight (L)	3. Vincent's angina (D)
4. Lack of mental application (L)	4. Minimal changes in tongue color or texture (D)
5. Loss of strength (L)	5. Red swollen lingual papillae (D)
6. History of sore mouth or tongue (L)	6. Glossitis (D)
7. Chronic diarrhea (L)	7. Papillary atrophy of tongue (D)
8. Nervousness and irritability (L)	8. Stomatitis (D)
9. Burning, pricking of skin, paresthesias (L)	9. Spongy bleeding gums (L)
10. Night blindness (N)	10. Muscle tenderness, extremities (D)
11. Abnormal intolerance of light, photophobia (L)	11. Poor muscle tone (D)
12. Burning or itching of eyes (L)	12. Loss of vibratory sensation (D)
13. Abnormal discharge of tears, lacrimation (L)	13. Increase or decrease of tendon reflexes (D)
14. Muscle and joint pains, muscle cramps (L)	14. Hyperesthesia of skin (D)
15. Sore bleeding gums (L)	15. Bilateral symmetrical dermatitis (D)
16. Tendency to bleed (N)	16. Purpura (D)
	17. Dermatitis; facial butterfly casal necklace, perineal, scrotal, vulval (D)
	18. Thickening and pigmentation of skin over bony prominences (D)
	19. Nonspecific vaginitis (D)
	20. Follicular hyperkeratosis of extensor surfaces of extremities (D)
	21. Rachitic chest deformity (D)
	22. Anemia not responding to iron (D)
	23. Fatigue of accommodation (D)
	24. Vascularization of cornea (D)
	25. Conjuctival changes (D)

Marginal nutritional deficiencies are more common in this country than most people realize. Uncomplicated nutritional deficiencies are rather rare, as most bad diets are low in more than one essential factor. The deficiency symptoms observed in malnutrition may be due to the combined effect of the deficiency of several factors. Furthermore, a number of the signs and symptoms listed in the table such as "failure to gain weight," are common to nearly all single nutritional deficiency conditions. It must also be borne in mind that the symptoms listed in this table may be a result of many other pathological conditions than nutritional deficiencies.

The detection of an early stage of dietary deficiency is important. Some signs are such as might be noticed by observant laymen, such as parents or teachers, for example; others obviously require for their detection the more detailed knowledge and experience of a nurse; still others will be seen and properly interpreted only by the skilled physician. The classification of symptoms and signs was prepared by the Subcommittee on Medical Nutrition, Division of Medical Sciences, National Research Council. The letters L, N and D in parentheses refer to layman, nurse and doctor, respectively, as the persons who might be expected to make the observation in question.

On the last page of the Health News of Rochester, New York, there appear from time to time excellent bits of advice. Several of these appearing recently are especially apt and are worth quoting with this discussion.

COMMON-SENSE HEALTH PRACTICES

Human bodies wear out. Rest when fatigued.
Excessive eating causes complaints. Don't overeat.
Sleep is as essential as food. Get sufficient sleep.
Teeth require constant care. Neglect is costly.
Recreation relieves mental strain. Learn how to play.
Have an annual physical examination. It pays.

Death does not hurt us, but disease does, because disease constantly reminds us of health and yet withholds it from us.—*Rabindranath Tagore.*

A HIGH SCHOOL STUDENT'S FINAL EXAMINATION

1. Am I eating the proper amount and kind of food I need?
2. Am I getting sufficient exercise and rest every day?
3. Have I protected myself against preventable diseases?
4. Am I forming good habits and trying to overcome bad habits?
5. Do I exercise good judgment in the prevention of accidents?
6. Do I make an effort to control my emotions?
7. Do I treat others as I would like them to treat me?

The health of the people is really the foundation upon which their happiness and all their powers as a state depend.—*Disraeli—1790.*

Review Questions

What value do you find in a personal health scale such as that prepared by Dr. Wood?

What is the importance of the dietary history sheet here presented?

What is the significance of the wheel of health?

Of what value are periodic health examinations?

PART II

FOOD REQUIREMENTS UNDER SPECIAL CONDITIONS

CHAPTER XX

NUTRITIONAL NEEDS IN NORMAL PREGNANCY

It has been said that the capacity for reproduction is a function of the well-being of the animal, and that dietaries which affect the general well-being either adversely or favorably will affect this function in a like manner. In other words, the ability of an animal to reproduce and rear young successfully is a criterion of fitness and vigor. In fact, the nutritive value of a ration may be appraised by the number of healthy litters of young which can be raised while the mother feeds upon it.

The effect of good nutrition on fertility of animals has long been recognized. As early as 1921, sows on an A deficient diet were reported to give birth to malformed offspring. Later reports describe pigs without eyeballs, with cleft palates, harelips, accessory ears, misplaced kidneys, etc. In 1940, Warkany and his co-workers were able to show that deficiency of riboflavin was important. They produced abnormalities in one litter, could prevent it in the next, produce it again at will, indicative that the diet injured the offspring rather than the mother.

Any dietary deficiency, whether it be deficiency of vitamins, minerals, protein, or total calories, will have its influence upon fertility. Vitamin deficiencies operate in various ways, as has been pointed out under that discussion. McLester expresses the idea when he says "reproduction is not the function of the generative organs alone, but of the whole organism; the well-being of the entire animal is of determining influence." One vitamin, E, is specifically designated as the antisterility vitamin, and it is needed for the reproduction of certain animals. Its specific place in the human being is not proved, its effectiveness in preventing repeated abortion having been both confirmed and denied. In ad-

dition to vitamin E, extreme deficiency of vitamins A, B, C, or of essential fatty acids has been shown to result in sterility of animals.

The logical diet in pregnancy is the normal diet of the mother enriched to permit her to produce another life without sacrifice of herself. Should any food essential necessary for the development of the growing child be absent from her diet, the mother's body tissues will be called upon to supply it. To prevent such loss there must be *adequate* protein, minerals, and vitamins, or structural material.

During the first half of pregnancy there is no increase in metabolic rate, and no calorie increase is necessary; in fact, it is undesirable if the woman's weight is essentially normal. After the fourth month more rapid fetal development calls for an increased calorie intake until just before delivery when there is 20 per cent metabolic increase and an approximate weight increase of 15 to 20 pounds.

Fig. 65.—Photograph of two puppies after being fed for eighteen weeks from weaning on the same diet, deficient in vitamins A and D. Puppy 1 (left) was the offspring of a mother fed during pregnancy and lactation on a diet rich in vitamins A and D and containing bread as the cereal; whereas, the mother of puppy 2 (right) was fed on a diet deficient in these vitamins and having oatmeal as the cereal. It will be noted that puppy 1 shows little sign of rickets, while puppy 2 has developed severe rickets. (Courtesy of Controller of H. M. Stationery Office from Medical Research Council Report No. 167.)

The diet of the pregnant woman should contain adequate amounts of protein of high biological value, milk, eggs, and meat. Especially important is the calcium, phosphorus, and iron intake. In regard to the vitamins, as we have already said, a deficiency of any one of them is highly undesirable. At this time supplementa-

tion of the normal diet by cod-liver oil or some other source of vitamin D is necessary, if normal structural development is to take place. (See Recommended Allowances, Chapter XVI.)

While during pregnancy it is important that the diet shall be adequate and the health of the prospective mother optimum, it must be remembered that health, habits of rest, exercise, bathing, serenity of spirit, are all factors which may play important roles.

At no other time in life is the daily quart of milk so necessary as when the mother is carrying her child. The calcium need is increased at this time, and 2 gm. daily is the preferable intake. This cannot be accomplished without the inclusion, as a minimum, of the quart of milk. In addition, it will be remembered, milk will contribute phosphorus and vitamins A, B_1 and B_2, and this quart will help protect against deficiencies of these vitamins. By including cream soups, custards, cocoa, etc., it will not be difficult to consume this amount.

The daily inclusion of meat or fish increases the level of intake of protein to the daily optimum of 85 to 100 gm. Diets in pregnancy are no longer restricted in protein to reduce kidney work. There is no sound basis for such restriction, except in certain toxemias which occasionally develop. Such complications as the toxemias are outside the scope of this discussion of normal pregnancy. Protein restriction is harmful in normal pregnancy. The inclusion of fish once or twice a week increases the iodine intake, which is desirable (see discussion of Iodine in Chapters IX and XI), because with the added strain of pregnancy thyroid abnormalities may develop. Liver contains many dietary essentials and is effective in preventing the development of anemia, often a complicating condition in pregnancy. One or two eggs a day add phosphorus, sulfur, some iodine, lecithin, vitamins A, B, and D, iron, essential fatty acids, and fat in a finely emulsified form which is readily digestible.

If not contraindicated, the whole grain cereals should be used in preference to the highly milled ones. The tendency toward constipation (due to pressure of the enlarging uterus on the intestines) may be corrected by cereal roughage, and good use is made of the vitamin and mineral content of the whole grain products. For the same reason, liberal amounts of green, leafy vege-

tables and fruits should be consumed each day. Two servings of each should be routine procedure.

A plentiful amount of liquid, especially water, will facilitate the work of the kidneys in eliminating certain metabolic end products and should be the practice unless definitely contraindicated.

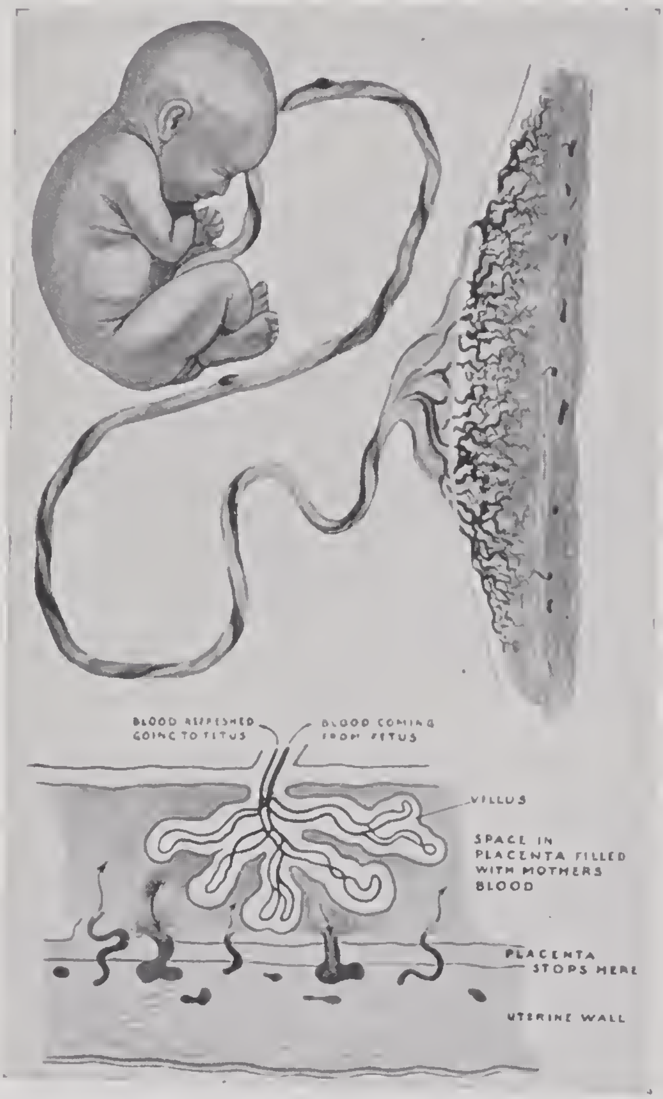

Fig. 66.—Diagrams to show the relation of the maternal and fetal circulations. (From Bogert: *Nutrition and Physical Fitness*, W. B. Saunders Co.)

One of the several important studies carried out to determine the effect of diet on pregnancy was that by Dr. Harry Ebbs from the Department of Pediatrics of the University of Toronto.

Briefly, a group of pregnant women found to have very poor diets were divided into two groups. One group of 120 women on poor diets and with low incomes were followed during the last half

of pregnancy as controls for 90 women on equally poor diets and low incomes who were supplied with milk, eggs, cheese, oranges, canned tomatoes, wheat germ, and vitamin D capsules, and who were instructed in the type of diet necessary for pregnancy. The observations made throughout pregnancy, during convalescence, and upon the baby showed a striking difference. The incidence of miscarriages, premature births, and stillbirths, the number of infections in the mother, and her general condition, both mental

TABLE 50

DIET IN RELATION TO COMPLICATIONS IN PREGNANCY

Complications During Pregnancy		
COMPLICATION	POOR DIET	SUPPLEMENTED GOOD DIET
Anemia	28.6%	16.1%
Toxemia	7.6%	3.4%
Threatened miscarriage	8.4%	1.1%
Miscarriage	6.0%	0
Premature birth	8.0%	2.2%
Stillbirth	3.4%	0
Breast abscess	3.0%	1.1%

*Obstetrician's Rating of Patient During Pregnancy**			
		POOR DIET	SUPPLEMENTED GOOD DIET
Prenatal period	Good	64	91
	Poor	36	9
Labor	Good	76	97
	Poor	24	3
Convalescence	Good	88	96
	Poor	12	4
Whole course of pregnancy	Good	66	94
	Poor	34	6

*The obstetrician was unaware of the diet group to which each patient belonged.

and physical, were much better in those who received the extra food. Changes in the blood of the mothers given extra food gave evidence that they were in better condition during the stress of pregnancy. The general condition of the babies born of mothers who received the extra food was much better than the condition of those born of mothers who were left on their poor diets. The incidence of illness among the babies was much greater in the poor diet group.

While it is well recognized that there are many factors in the successful outcome of pregnancy, it seems reasonable that proper

nutrition will insure a more optimum general condition of the mother, which will possibly prevent, or at least minimize, the complications which occur in pregnancy. The tired, depressed, and physically poor women in the above study, with a past history of a high percentage of complications, were poor obstetrical risks. But even in four or five months of proper feeding, this condition was greatly improved and the outcome of pregnancy was not only better than with those who were left on their poor diet, or who ate what was termed a "good diet," but resulted in a lower rate of complications than they had experienced in previous pregnancies.

Other studies on methods of evaluating the nutritional status of mothers and infants have been carried out or are in progress; data are accumulating. One of particular personal interest is the extensive and intensive program in progress at the University of Rochester Medical School under Dr. Scrimshaw.

As in any dietary study where control cannot be absolute, and even then, the personal equation and unsuspected subclinical and psychological effects obviously influence the evaluation of the data.

The disturbances manifested by nausea and vomiting in the early months of pregnancy result, according to one theory, from

TABLE 51

The diet of the pregnant woman may be summarized by indicating a minimum need for:

1 quart of milk or its equivalent through the use of cheese. Skim milk may be preferred due to caloric difference. Cooking with milk may replace drinking it.
At least 1 egg.
A generous serving of meat, fish, or poultry. Liver once weekly is desirable.
A leafy green or yellow vegetable—preferably as a tossed salad.
A second vegetable—20 per cent vegetable in moderation.
A citrus fruit or other specific source of vitamin C.
A second fruit.
3 pats of butter or fortified margarine.
3 servings of enriched cereal—excessive amounts of cereal should be avoided due to the high caloric value.
A source of vitamin D.
Moderation in desserts, nuts, candy, etc., in order to avoid excess caloric intake or replacement of foods currently having greater desirability.
In certain instances mild limitation of salt and avoidance of excessive fluid intake may also be desirable. Otherwise salt in moderation and a generous intake of fluid are recommended.
For many women a six-meal schedule may be preferable to three—at least extra nourishment in the morning, afternoon, and at bedtime.

the incomplete establishment of the connection between the embryo and the mother. These disturbances are not due to disagreement of food or to digestive upset. Usually increased intake of carbohydrate and decreased intake of fat, and smaller and more frequent meals with a light breakfast before rising, will result in greater comfort. Pyridoxine in doses of 10 to 100 mg. has been used with some success in the control of nausea. If the vomiting persists ("pernicious vomiting"), medical advice should be sought.

The craving for certain foods during pregnancy should be satisfied only after basic essentials have been supplied. When the basic needs have been met, the dictates of appetite may be followed as desired, with precaution against unwanted weight change. These cravings, or chance unpleasant sights or thoughts, it must be remembered, have no effect upon the developing fetus, superstition as to "markings" of old wives' tales to the contrary. If it had, few children would be born physically perfect. There is no nerve connection between mother and child, but only an exchange of soluble materials through the placenta and umbilical cord. These two structures develop during pregnancy to supply structural material and oxygen to the fetus and for the removal of waste.

About the third month of pregnancy the development of the fetus is complete, and it lies inside a closed membrane, completely filling the inside of the uterus. Here, as an aquatic animal, the child lives in a world all its own, shielded and protected to the utmost degree, until delivery.

Review Questions

If the mother's weight is normal, is calorie increase necessary in the early months of pregnancy?

How great an increase in calories is necessary in the latter half?

Is the diet of a pregnant woman a "special diet"?

To what food nutrients should special attention be paid during pregnancy?

What means may be used to overcome the nausea of the early months of pregnancy?

CHAPTER XXI

COMPLICATIONS IN PREGNANCY

Pregnancy is a normal, physiologic function, and under most circumstances proceeds to term without complications. When abnormal conditions arise, however, special treatment must be instituted dietetically and medically.

"Morning sickness" (a mild toxemia) appears in about 50 per cent of all pregnancies, and in a certain sense its discussion, therefore, belongs to Chapter XX. In the usual type of vomiting little alteration in diet composition is necessary, as breakfast, high in carbohydrate and eaten in bed, will usually offset the condition. However, if it persists throughout the day, high carbohydrate meals, smaller in amount and eaten at more frequent intervals, may help to control the vomiting. If the vomiting becomes pernicious, food by mouth is withheld for twenty-four to forty-eight hours, and infusions of normal saline and of 5 to 10 per cent glucose are given. The total volume required will depend upon the degree of dehydration of the patient, usually 2,500 c.c. or more. If a ketosis is present, insulin and glucose are sometimes given. As food tolerance returns, the patient should be permitted to eat what she desires, rather than to force a planned diet upon her. After the acute period has passed, the diet can be readjusted. In the meantime commercial vitamins and minerals may be used to prevent deficiencies.

Eclampsia (convulsive seizure during pregnancy) in mild or severe form may be a complication of pregnancy. Dietary control is a matter of debate. Some authorities contend that protein should be sharply curtailed, others say that it should be increased, and still others maintain that it should be left at normal level. Low serum proteins are apt to follow low protein intake, and they predispose to edema.

It has been suggested that certain anatomic and physiologic departures from the normal render pregnant women susceptible to renal and vascular strain. These women appear to be well before conception, but with the strain of pregnancy they exhibit manifestations of toxemia. They frequently show hypoproteinemia,

and many believe that this arises largely from inadequate intake of protein in the face of an increasing need. This low level of serum protein may be the cause of headache, dizziness, and other pre-eclamptic symptoms. An abundance of good protein is the logical preventive measure for the low blood protein level.

Protein level has long been a matter of contention. Many obstetricians have been of the opinion that a metabolic disturbance was the causative factor and, therefore, sharply curtailed protein intake in their patients. The fallacy of this treatment is becoming evident. Today treatment is directed toward adequate nourishment of the woman, with particular emphasis on protein, vitamins, and minerals. Effort is made to spare all possible physical, nervous, and metabolic strain, to avoid the necessity for termination of the pregnancy.

Once eclampsia has supervened, diet plays a minor role.

Review Questions

If vomiting becomes pernicious in pregnancy, what means are used to combat it?

What is the modern theory in regard to protein intake during pregnancy and its possible connection with eclampsia?

CHAPTER XXII

LACTATION

During lactation the child continues to live at the expense of the mother and is dependent upon her for food. Hence, if the child is to continue developing, and is to receive breast milk adequate in quantity and quality, the mother's food intake must be sufficient to meet the demand. The food increase should not, of course, be great enough to result in unwanted weight gain in the mother, but it should be enough to provide adequately for the child's nutrition. Experts tell us that no other food can equal human milk for child nutrition. Every child has the right to start life with a sound, healthy body. This is a reflection of the mother's health during pregnancy. He has, further, a right to a good start after birth and this is best afforded by breast feeding. If during pregnancy proper diet and health habits have been established, the chance for normal lactation is greatly increased. One cannot hope that a sudden dietary change at the termination of pregnancy will be so effective in producing milk.

Human milk differs from cow's milk in composition. Human milk contains less protein and protein of a different type; the lactalbumen fraction is greater and the casein fraction is less than in cow's milk. The curd formed from the action of gastric juice on human milk is much finer than that formed in cow's milk, due to the lower casein content. The finer curd presents greater surface area for the action of the digestive juices in human milk, and hence greater ease of digestion and more complete digestion of the curd. The denser curd of cow's milk may at times escape digestion and some of its calcium, as well as protein, may thereby be lost to the body.

The comparative *approximate** percentage composition of human and cow's milk is given in Table 52.

The higher protein content of cow's milk is related to the difference in growth rate of the young of the two species. The widely quoted table of composition of milk, compiled by Proscher (Ztschr.

*Values for the composition of milk vary according to the stage of lactation—whether it is early or late in the lactating period, to the diet ingested, and to the breed of the animal.

Table 52

Approximate Percentage Composition of Human Milk and Cow's Milk

	FAT	SUGAR	TOTAL PROTEIN	LACTALBUMIN	CASEIN	TOTAL ASH	CA
Human milk	3.50	7.50	1.25	0.75	0.50	0.20	.034
Cow's milk	3.50	4.70	3.40	0.50	3.00	0.75	.122

	Mg	K	Na	P	S	Cl	Fe	Cu
Human milk	.005	.048	.011	.015	.0036	.036	.00010	.00003
Cow's milk	.013	.154	.060	.090	.0310	.116	.00004	.00002

f. physiol. Chem. 24: 285, 1898) shows nature's preparation for growth rate in various animals (see Table 15).

The salt percentage in the ash of human milk is given in Table 16.

Table 53

Ash Constituents of Human Milk

	Per Cent
Calcium phosphate	23.87
Calcium sulfate	2.25
Calcium carbonate	2.85
Calcium silicate	1.27
Potassium carbonate	23.47
Potassium chloride	12.05
Potassium sulfate	8.33
Magnesium carbonate	3.77
Sodium chloride	21.77
Ferric oxide and aluminum	0.37
	100.00

During lactation the mother's caloric intake must obviously be greater than at other times. The average infant requires approximately 2½ ounces of milk per pound of body weight each day—approximately 50 calories per pound, or 110 calories per kilogram a day. When a baby is breast fed, it is wise to ascertain how closely his intake approaches his requirement. With no change in clothing, the difference in weight of a baby before and at the completion of nursing, is a measure of the food ingested. Other criteria of adequacy are satisfactory weight gain, happiness of the baby, and his sleeping habits between feedings.

The normal infant weighs 6 to 7 pounds at birth, doubles his weight in five to six months, and triples it by the end of the first year. There should be steady weight gain of about 4 to 8 ounces

weekly, 6 to 8 ounces in the first six months, and 4 to 6 ounces in the second six months. If the mother's milk could be produced with perfect efficiency, there would be immediate need at parturition (if the child weighed 7 pounds) for approximately 350 extra calories daily in her diet, as can be seen by the calculation 7 pounds × 2½ ounces of milk per pound × caloric value of 20 calories per ounce for milk.

Considering the normal weight gain, it is found that during the first month the daily requirement of the infant will be roughly 500 calories daily, during the second month 600 calories, during the third 700, and so on (see Chapter XXIII). The food requirement of an infant is roughly three times as great per unit of body weight as that of an adult.

The production of milk is not accomplished with efficiency. There is dissipation of energy and food value in the transfer of food material from the mother's diet to her milk. Therefore, more is involved than simply meeting the baby's requirement. Experimentally, it has been shown that only 50 per cent of the food protein is converted into milk protein; consequently, for every gram of milk protein the mother's diet must contain 2 gm. of food protein. The protein value of human milk is variously given from 1.25 to 2 per cent—an average of 1.6 per cent protein, or 0.45 gm. protein per ounce × 17.5 ounces of milk (7 lb. × 2½ oz.) = 7.88 gm. of milk protein. To obtain this extra 8 gm. of milk protein, 16 gm. of food protein must be eaten.

The precursors of the other constituents of milk are found in the mother's blood as the end products of her digestive processes. There is evidence of a vitamin loss between the mother's blood and her milk, especially loss of the vitamin B complex. An increase in vitamin B complex is, therefore, recommended for the mother's diet. Vitamin C of the milk is dependent upon its content in the diet. Unpublished data, obtained by one of us, indicate that the ingestion of fruit between one and two hours before the nursing period, rather than at mealtime, assures an increased level of vitamin C in the breast milk at nursing time. Only by a more than adequate intake of vitamin C by the mother can the baby be assured of his share. From a 50 per cent increase to a doubled intake is suggested. Unless the child is receiving a fish-liver oil, the mother's diet should contain such a supplement to

assure optimum bone development in the child. It also has a protective value to the mother herself, inasmuch as some of the vitamins A and D of her food are diverted from her body use to the milk she produces.

To summarize, the diet during lactation must have a caloric intake up to 50 per cent greater than the diet at the end of pregnancy. (One calorie as milk requires approximately two calories of food.) It must also have higher protein level, especially of foods having high sulfur content, increased calcium, phosphorus, and iron, and an increased vitamin intake. These requirements will be met if the diet contains basically each day, one to one and a half quarts of milk, a generous serving of meat or fish (liver twice a week), one or two eggs, cheese, a glass of orange or grapefruit juice (200 c.c. either fresh, frozen, or canned, or the pulp equivalent), two vegetables other than potato, a second fruit, a generous serving of butter or fortified margarine, and a cereal and cereal product, both prepared from whole grain, or a cereal reinforced with wheat germ or one of the "enriched" flours or cereals. As a dietary factor, not as medication, the inclusion of a fish liver preparation is a wise precaution.

The increased need during lactation is indicated by comparing the values recommended by the Food and Nutrition Board (Table 54).

Lactation may be influenced by factors in addition to the basic biological limitation and adherence to a dietary regime of higher caloric, protein, and vitamin intake.

Table 54

	CALORIES	GM. PROTEIN	GM. CA.	MG. FE.	I.U.A.
Woman (125 lb., 56 kg.)					
Sedentary	2,000	60	1.0	12	5,000
Moderately active	2,400	60	1.0	12	5,000
Very active	3,000	60	1.0	12	5,000
Pregnancy (latter half)	2,400	85	1.5	15	6,000
Lactation	3,000	100	2.0	15	8,000
	MG. B_1	MG. B_2	MG. NIACIN	MG. ASCORBIC	I.U.D.
Woman (125 lb., 56 kg.)					
Sedentary	1.1	1.5	11	70	
Moderately active	1.2	1.6	12	70	
Very active	1.5	2.0	15	70	
Pregnancy (latter half)	1.8	2.5	18	100	400
Lactation	2.0	3.0	20	150	400

Adherence to this dietary should bring favorable results, but it must be remembered that psychic influences have tremendous force. Freedom from worry, sufficient rest, happiness, general relaxation, and good health habits are essential.

Breast feeding should be continued, if possible, at least until after the sixth month, and may be continued until the seventh or eighth month. The exact time will depend upon a number of factors, the milk supply, health of the mother and child, and environmental conditions. Weaning is preferably done gradually, over a month's period.

While the "mixed" feeding is being carried out, the amount of food received from the breast must be determined in order to calculate the amount of supplement necessary for adequate feeding.

Review Questions

Is there need for calorie increase in the diet of the mother during lactation?

Should the amount of any of the food nutrients be increased? If so, what ones?

Can proper diet alone assure successful breast feeding of the baby?

Are there any other factors which may influence milk production?

When should the preparation for lactation begin?

CHAPTER XXIII

THE FEEDING OF INFANTS

Breast feeding of infants is the preferred method during the first six months. Rarely is there a child who cannot tolerate his mother's milk. With a cooperatively planned program by the physician and mother it has been estimated that at least 85 per cent of women can nurse their babies for at least a few months.

Gurlee in his 1935 Chicago study found that in a series of 9,449 babies, 48.5 per cent were breast fed and in this group the mortality was 1.1 per thousand. In the group where there was mixed breast and bottle feeding the mortality was 5 times as high and in the completely bottle fed it was 10 times as high. Of course, one must recognize the factor of intelligence and sanitation in the figures for bottle fed babies.

Breast feeding has the advantages of requiring no modification of the milk, it obviates the danger of contamination, and it is less effort for the mother. It does interfere with the mother's free time, and where this is a hardship to the point that breast feeding might be discontinued, the use of one bottle feeding a day may be adopted. In inability to produce milk, active tuberculosis or other disease condition, artificial feeding must be used. During infancy, whether the feeding be artificial or natural, the schedule outlined later in this chapter should be observed.

As has been pointed out in the preceding chapter on Lactation, the approximate food requirement for any infant can be calculated. The amount must be sufficient to permit a steady weight gain of from 4 to 8 ounces weekly, after the first initial loss in weight has occurred. A slow, steady gain is desirable. The best criterion of proper feeding is this steady weight gain, coupled with a happy baby (one who is not restless or irritable) whose recovery from minor ailments is rapid, and who has bouts of neither diarrhea nor constipation.

Complicated formulas have been used in the past when breast feeding was impractical. Today, greatly simplified formulas feed the child as adequately.

As in the planning of diets for the adult, certain requirements must be met. The approximate caloric need is of first consideration and for the normal growing infant is indicated below:

Murlin, in discussing the normal processes of energy metabolism,* emphasizes the multiplicity of factors concerned in building up the energy requirement of an infant (Table 55).

TABLE 55

Basal metabolism	60 calories per kilogram
Activity metabolism (12-40% of basal)	7.2-24.0 calories per kilogram
Loss by feces (10-15% of basal)	6.0- 9.0 calories per kilogram
Dynamic action (10-20% of basal)	6.0-12.0 calories per kilogram
Growth (10-20% of basal)	6.0-12.0 calories per kilogram

At the White House Conference on Child Nutrition in 1932, the total caloric intake of normal growing infants of different ages was averaged from findings in the literature in terms of need for twenty-four hours, as indicated in Table 56.

The **caloric requirement** is roughly 2½ to 3 times that of the adult on a weight basis. This obviously is due to the extremely high growth rate. The child, on the average, doubles his birth weight in 5 months and triples it by the end of the first year, during which time he has grown 8 to 10 inches in height.

In the first weeks of life the need is 120 to 100 calories per kilo per 24 hours, at 6 months 110 to 100, at 1 year 100 to 85, etc. Assuming a baby of average birth weight of around 7½ pounds (3.4 kilo) and assuming normal development and need, the total *rough* caloric requirement for a 24-hour period will be that shown in Table 56.

TABLE 56

AGE	CALORIES
1 month	500
2 months	600
4 months	700
6 months	800
9 months	900
1 year	1000
2 years	1200

*Murlin: *Endocrinology and Metabolism*, D. Appleton-Century Co.

It must be remembered that *children differ.* They cannot be fed from a set pattern. Intelligent interpretation of specific needs is one of the secrets of successful feeding.

The second consideration is the **protein level.** The protein requirement is directly proportional to the growth rate. (See Table 15.)

Examination of the **composition of human and cow's milk** (Table 52) indicates roughly a double amount of protein in cow's milk. In the past, modification included dilution of cow's milk to half value in order to bring this component down to a comparable protein level. This is no longer the practice. The two proteins are different in structure. Proteins of milk are of two kinds: lactalbumin (whey protein) and casein or curd protein. Lactalbumin has been thought to have greater nutritive value, probably due to its high cystine—a sulfur-containing amino acid—content. The protein of human milk is roughly 60 per cent lactalbumin, cow's milk but 15 per cent. Whether or not this is the complete answer is not clear; however, the fact remains that infants fed a higher level of protein in the form of cow's milk do better than those whose protein percentage is that of human milk. (Recently, experimental work has been reported suggesting the two milk proteins are of equal value for maintenance of the normal adult. This needs confirmation and extension into other types of use.) The customary level of 2 to 2.5 gm. of protein in the form of human milk and 3.5 to 4.5 gm. when fed as cow's milk is satisfactory (or roughly, twice as much when protein is from bovine sources). The figure, 4 gm. protein per kilogram, is easy to remember. This is the amount of protein supplied by ½ cup of milk (32 gm. per quart is approximate value). The value of 4 gm. of protein per kilogram represents not far from the 10 to 15 per cent of the total caloric level suggested for adults.

3.4 kilo baby × 4 gm. protein per kilo = 13.6 gm. protein.
3.4 kilo × 120 calories per kilo = 408 calories.
13.6 gm. protein × 4 calories per gm. = 54 protein calories or 13 per cent of the caloric intake.

The following, taken from Levine's discussion of "Protein in Pediatrics"* tabulates the range of protein allowances at different age levels.

*J. A. M. A. 128: 283, 1945.

TABLE 57

RECOMMENDED DAILY ALLOWANCES FOR PROTEIN, EXPANDED FOR THE GROWING PERIOD

SUBJECT	AGE	PROTEIN IN GRAMS* TOTAL 1	PER KG. 2	PER LB. 3	% OF DIETARY CALORIES AVERAGE
Premature†	1 week to 1 month		6.0-4.4	2.7-2.0	17
Premature‡	1 week to 1 month	4-3	5.0-4.4	2.3-2.0	15
Premature	1 to 3 months	per	4.4-3.3	2.0-1.5	13
Full term	2 days to 3 months	Kg.	4.4-3.3	2.0-1.5	13
All infants	4 months to 1 year		4.0-3.0	1.8-1.4	13
Toddlers	1 through 3 years	40	(4.2-2.9)	(1.9-1.3)	(13)
Preschool	4 through 6 years	50	(3.3-2.5)	(1.5-1.1)	(13)
School	7 through 9 years	60	(2.6-2.1)	(1.2-1.0)	(12)
School	10 through 12 years	70	(2.2-1.8)	(1.0-0.8)	(11)
Youths, female	13 through 15 years	80	(1.8-1.5)	(0.8-0.7)	(11)
Youths, male	13 through 15 years	85	(2.0-1.7)	(0.9-0.8)	(11)
Youths, female	16 through 20 years	75	(1.6-1.4)	(0.7-0.6)	(13)
Youths, male	16 through 20 years	100	(2.1-1.7)	(1.0-0.8)	(11)

*Column 1 gives the allowances recommended by the Food and Nutrition Board, columns 2 and 3 the suggested modifications for infants. The figures in parentheses in these columns, beyond 1 year, represent the total allowances in the original recommendations (column 1) per unit of body weight on the basis of average weights for age groups derived from the tables of Baldwin and Wood.

†Premature infants weighing less than 2,000 gm. (4 pounds 6 ounces).

‡Premature infants weighing 2,000 gm. and over.

The **fat** in the diet of the infant supplies from 30 to 40 per cent of the caloric need. Were it not for this concentration, the child's caloric need would have to be met by too great bulk. When intolerance to fat exists, the level may be reduced to 20 per cent, but unless absolutely necessary a level below this is borderline for adequacy of fat-soluble vitamins and essential fatty acids. The fat level of milk from a mixed herd is approximately 3.5 per cent. Such milk is preferable to that of higher fat content (Jersey, Guernsey). On a weight basis this is calculated to be approximately the same as protein—4 gm. fat per kilogram of body weight.

The fat of human milk is in the form of finer globules than that of cow's milk. Homogenization, evaporaton, and drying accomplish the same effect, hence such milks are somewhat more easily digested.

The carbohydrate caloric proportion is approximately 50 per cent of the total. Milk alone with its carbohydrate content at a 5 per cent level would not be sufficiently high calorically to yield this percentage of calories. Since human milk has 2 per cent more carbohydrate than cow's milk, it is logical to supplement

by this means. Usually 3 to 5 per cent carbohydrate is added, making the formula milk 8 to 10 per cent sugar. The type of sugar added is a matter of preference.

There is much discussion as to which sugar is best in infant feeding. As an editorial in the *Journal of the American Medical Association** once stated: "The 'styles' in nutrition to which children are subjected in the earliest periods of life have changed from year to year, sometimes in almost a bizarre manner." Lactose, sucrose, maltose, dextrose, and dextrimaltose, have all been recommended from time to time by means of skillful advertising. The question of digestibility and absorption, as well as the caloric value and the cost, must be taken into consideration in making a choice. The chemical structure may be of importance metabolically. For instance, dextrose is blood sugar while galactose is a component of the fat constituent of nervous tissue (see Chapters V and VI). It is conceivable that sugars which require breakdown before utilization, and are, therefore, slower of absorption, may produce diarrhea. On the other hand, this slower absorption might facilitate better deposition of glycogen, or other factors of physiologic use. These arguments are used for and against the several sugars. Unfortunately, prior to the twentieth century, when lactose was in general use, digestive upsets were attributed to it, and several clinical experiments were conducted which were interpreted to prove that lactose was toxic. Today we know that it is not, and that up to 17 per cent lactose can be used with entire success in the infant formula. Lactose would not be the natural sugar of milk if it were harmful to the young of any species. Nature would hardly make such a mistake. But some prejudice against lactose still exists today. Digestive upsets and failure to obtain response on a formula should not be attributed to the one factor of the sugar padding. The apparent disadvantages in the past were probably due to lack of proper sanitation and pasteurization. Other ingredients or actual infection, either within or without the gastrointestinal tract, must be considered.

There is difference in the density of sugars and the volume for a given weight varies (Table 58).

The popular choice of sugar today is corn syrup, and the usual addition of corn syrup is 5%. Karo corn syrup is a dextri-

*J. A. M. A. 96: 2, 1931.

TABLE 58

1 ounce of cane sugar equals 2 level tablespoonfuls
1 ounce of corn syrup equals 2 level tablespoonfuls.
1 ounce of lactose equals 3 level tablespoonfuls.
1 ounce of dextrimaltose equals 4 level tablespoonfuls.
1 ounce of these sugars equals 120 calories (4 cal./gm.).

maltose preparation. Its composition is 50% dextrin, 23.2% maltose, 16.0% dextrose, 6.0% sucrose, and 4.0% invert sugar.

Dark cane molasses, with its appreciable iron content, yields good amounts of vitamin B_6, some pantothenic acid, and some vitamin B_2, and should prove a satisfactory vegetable sugar. It is the crude sugar of the sugar cane. The green label brand of Br'er Rabbit Molasses contains 1 mg. of available iron per tablespoonful.

The preparation of the formula in the manner suggested above assures the child of an adequate **water intake.** Water is very important in the diet of a child. It should be supplied in amounts equal to 10 to 15 per cent of the child's weight (varying of course with weather, which influences loss). The 7½ pound child, 3.4 kilograms or 3,400 grams, will have a need of from 340 to 510 c.c. water daily. The water need for children is given in Table 59.

TABLE 59

125 c.c.	per	kilo	at	1	year
115 c.c.	per	kilo	at	2	years
100 c.c.	per	kilo	at	4	years
85 c.c.	per	kilo	at	10	years
50 c.c.	per	kilo	at	14	years

When a formula is prepared without the use of fluid milk—from evaporated or dried milk—the amount of water added in its preparation should be such that the child's water need is covered.

One tall can of evaporated milk (13½ oz.) diluted with an equal amount of water may be considered *roughly* equal to one quart of fluid milk, as is one cup of powdered milk made up to a one quart volume with water.

The usual milk formula is such in volume that it is equal to 10 to 15 per cent of the child's weight. See calculation in Table 60.

A simple and satisfactory formula calculation is 2 to 2½ oz. whole fluid milk per pound of body weight with the addition of 5 per cent sugar. The resulting modification will adequately cover the nutritional needs of the child.

TABLE 60

7½ pound baby × 2½ oz. milk equals 18.7 oz. milk
18.7 milk × 20 calories per oz. equals 374 calories
5% sugar would be approx. 1 oz. of sugar at 120 cal.
(18.7 × 5% equals 0.94 oz.—approx. 30 gm.—sugar × 4 cal. per gm.)
A total of 494 calories which adequately covers the need of 3.4 kilo (7½ lb.) @ 120 cal./kilo or 408 cal. leaving leeway for wastage.

When evaporated milk is used, it must be remembered that it is essentially double strength due to water removal: 7% P—7.9% F—10% C. Water must be added as diluent.

The total water or fluid intake in 24 hours must be adequate—approximately 3 oz. per pound. (See preceding discussion.)

TABLE 61

STRONG MEMORIAL HOSPITAL SCHEDULE

AGE	MILK OZ.	CORN SYRUP TBS.	CALORIES
Under 1 mo.	15	1½ (or ¾ oz.)	390
1 mo.	18	2	600
2 mo.	22	2¼	710
3 mo.	26	2½	860
4 mo.	28	3	920
5 mo.	29	3	940
6 mo.	30	2	840
7 mo.	31	1	740
8 mo.	32	0	640
9 mo.	32	0	640
10 mo.	32	0	640
11 mo.	32	0	640
12 mo.	32	0	640

Whole pasteurized milk is 14 to 12 per cent of body weight plus 5 per cent of corn syrup. Sugar is decreased around the sixth month.

For discussions of formulas other than those suggested here, the reader is referred to texts on the subject of infant nutrition.*

As will be noted, when supplementary foods are added, the caloric value of the formula decreases. The total caloric intake from food, however, increases as indicated in Table 64.

*See section on reference material, Part V.

The use of acid milk, protein milk, and of milk substitutes may be necessary. The acid and protein milks are sometimes used in digestive disturbances, and the milk substitutes are used in allergy. The acid milks are usually partly defatted or skimmed milks which have been acidified by lactic acid, citric acid, orange juice, or lemon juice. The addition of the acid produces a finer and, therefore, a more digestible curd. To a thoroughly chilled formula, 85 per cent lactic acid may be slowly added with constant stirring in the proportion of 4 c.c. to one quart. This results in a fine suspension of curd which does not settle out on standing. Too much acid, too warm milk, or too rapid addition of the acid, results in separation of the curd and whey. If great excess of acid is added, the curd is redissolved. Orange juice in the amount of 2 ounces to a quart of milk will produce practically the same fine curd.

Protein milk is milk enriched with protein. It can be obtained commercially, or it can be prepared at home by adding curd to whole, partly defatted, or skim liquid milk. The curd may be prepared by coagulating whole milk with commercial rennin (1 quart of milk at 100° F. to which is added a Junket tablet). The curd is collected and drained through cheesecloth and then rubbed through a fine strainer into lactic acid milk (1 pint). It is then strained again, and the volume is made up to 1 quart with boiled water. If higher protein content is desired, Casec (calcium caseinate) or powdered skim milk may be added to the milk. Milk may be padded to have a double or tripled protein content.

Occasionally, a baby will show sensitivity to cow's milk and substitution is necessary. Sometimes such a child will tolerate evaporated milk or "hypoallergic" milks, which have had their protein structure altered by heating. If neither of these suffices, soybean milk is probably the most satisfactory substitution. Commercial soybean products, such as Sobee, are available, or the milk may be prepared from the soybeans at lesser cost. The protein of the soybean (glycinin) is of high biological value, in contrast to most vegetable proteins. The soybean milk is prepared by adding to the soybean meal more than enough water to saturate it. This is allowed to stand for two hours, and then five times the volume of boiling water is added and the mixture is boiled for ten minutes, with constant stirring. It is then filtered through a fine cloth.

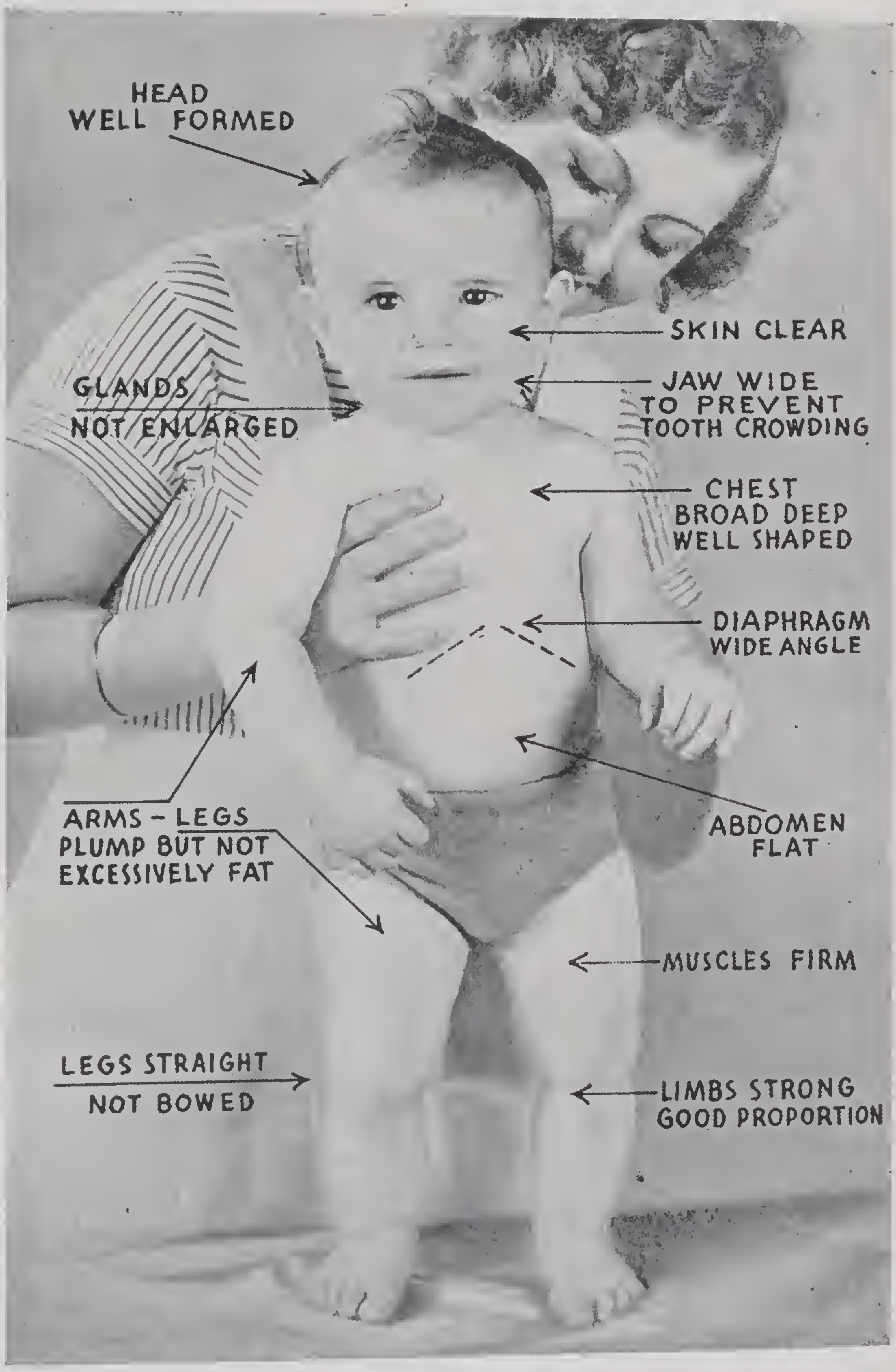

Fig. 67.—The healthy baby. (Courtesy of the California Fruit Growers Exchange.)

The fluid obtained looks not unlike cow's milk and has a composition of approximately 4% protein, 1.8% fat, and less than 1% carbohydrate. The addition of 2% vegetable oil (such as

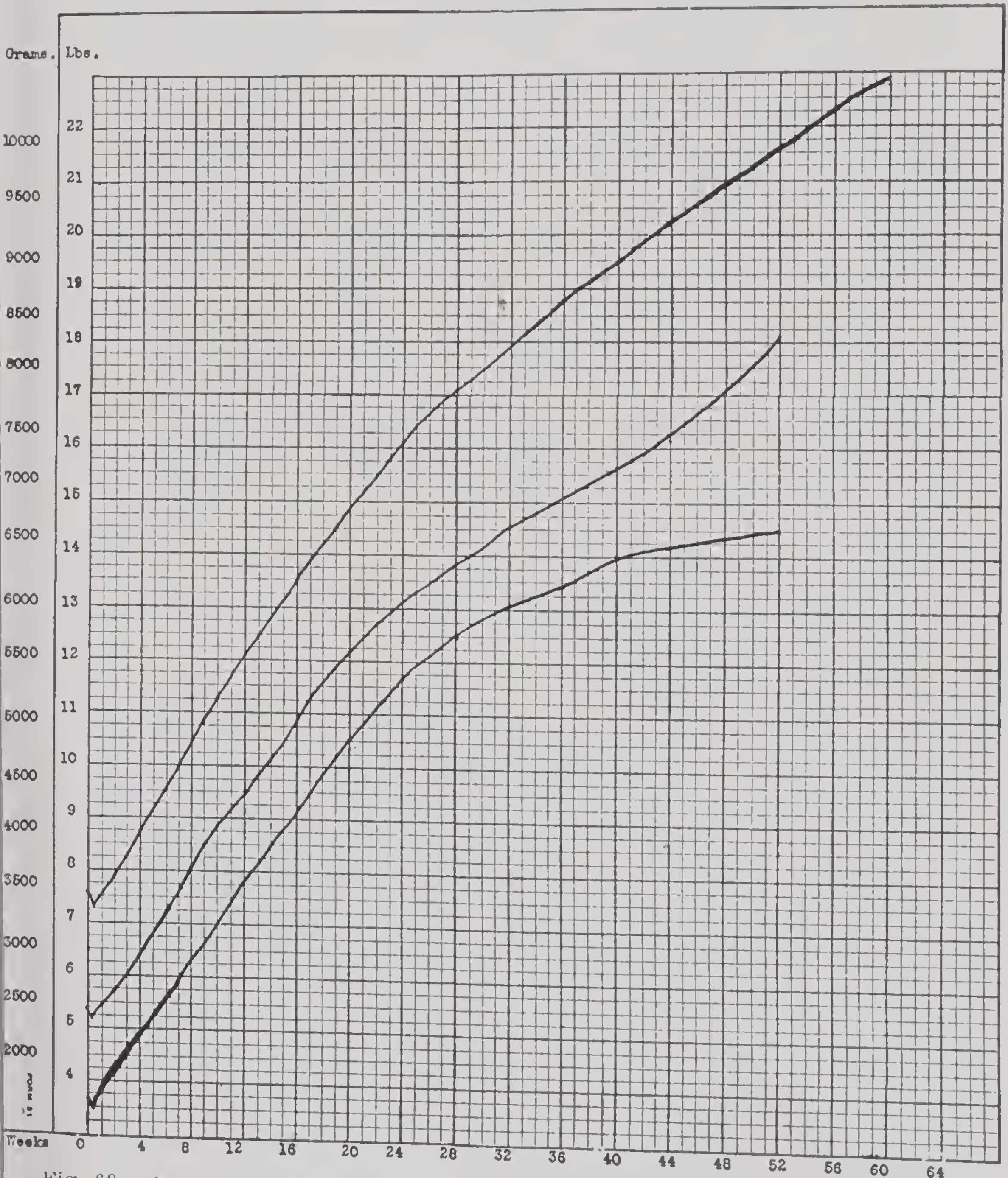

Fig. 68.—Average weight curves of infants during the first year of life. (After Camerer, from Marriott: *Infant Nutrition.*)

Wesson or olive oil) and 5% carbohydrate (lactose, glucose, or cane sugar) makes this a satisfactory milk substitute. The cost is about the same as for cow's milk.

The formula of Sobee powder is:

Soybean flour	61%
Olive oil	19%
Arrow root starch	9%
Dextrimaltose	6%
Dicalcium phosphate	4%
Sodium chloride	1%

By dilution it becomes 2.8% fat, 4.2% protein, 4.1% carbohydrate, and 1% salt.

Mull-Soy, another soybean preparation (an evaporated liquid), has a composition of:

Soybean flour
Soybean oil
Dextrose
Sucrose
Calcium phosphate
Sodium chloride
Calcium carbonate

When diluted according to directions, it yields:

3.0 %	protein
3.9 %	fat
4.4 %	carbohydrate
1.0 %	ash
0.18%	calcium CaO
0.25%	phosphorus pentoxide
87.7 %	water—20 cal. per ounce

If minimum cost is not a factor, one of the prepared foods, such as Biolac, or another similar product of which there are many, may be used. This is an evaporated liquid type of modified milk which, when diluted with an equal volume of water, has a percentage composition of

	Per cent
Milk fat	2.4
Lactose	8.2
Protein	2.8
Minerals	0.6
Water	86.0

and, in addition, a caloric value of 20 calories per ounce. It is fortified with a fish oil concentrate, ferric citrate, and thiamine, and hence contains per quart, 340 I. U. of vitamin D, 2,000 I. U. of vitamin A, 65 to 85 I. U. of vitamin B_1, and 6 to 9 mg. of iron.

The sixteen ounce (pint) can may be used with any volume of water desired. Such a product reduces formula preparation work to a minimum, supplies the need for cod-liver oil in early months, and is protective against iron deficiency. From this standpoint, the cost, approximately three times that of a similar can of plain evaporated milk is not as great as it seems. Such formulas, it must be remembered, usually require supplementation with vitamin C.

The actual preparation of the formula is important. If pasteurized milk is used, the milk is poured from the bottle (after careful outside cleansing) into a pan and brought to boiling with constant stirring, and held for three to four minutes at boiling point. It is then cooled quickly and the scum removed. It is diluted at this point with cool boiled water, if dilution is necessary, sugar having been added to the water. After thorough mixing, the formula is poured into clean, sterile bottles in correct amounts for single feedings, sealed, and stored in a cold place until just before feeding time, when a bottle is removed and warmed to body temperature.

If evaporated milk is used, it need not be brought to boiling, as evaporated milk is already sterile. The sweetened sterile water is added to the milk as it comes from the can, and stored in bottles, as above.

If dried milk is used (Klim), 1 part of the powdered milk to 4 parts of sterile sweetened water is mixed and stored. It has the advantage of supplying adequate calories at any liquid level.

Directions for acidification or protein reinforcement have been given earlier in this chapter.

Bottles and nipples should always be washed thoroughly, immediately after each feeding.

The lives of many premature infants are saved today by the care they receive. When hospitalized they are isolated in air-conditioned rooms, maintained at constant temperature, and are fed with great care. In most instances the baby is too weak to take the breast or the bottle, and a medicine dropper, or other type of feeder, is used. Breast milk from the child's mother, or from another source, is usually available. It is now possible to buy frozen breast milk. If it is not available a modified milk is prepared. Usually only water is given during the first twenty-four hours. Thereafter, at two- to three-hour intervals, dilute milk is fed, a

dilution up to 1 part milk and 3 parts water the first few days as tolerated, with increasing percentage of milk, until the usual formula, or a slightly richer formula, is given by the tenth day. Acidified milks are also frequently used for "the premature" as are dried milk formulas, which have the advantage of high nutritive value and low bulk by simple decrease in dilution. The recent use of puréed meat has proved useful as a formula addition.

Levine* suggests the following formulas for feeding the premature baby. They serve as well to demonstrate range and possibilities for formula prescriptions for older infants.

TABLE 62

FORMULAS FOR FEEDING PREMATURE INFANTS PER KILOGRAM OF BODY WEIGHT AND IN PERCENTAGES OF DIETARY CALORIES

MILK		SUGAR	WATER	PROTEIN		FAT		CARBOHYDRATE		CALORIES
TYPE	C.C.	GM.	C.C.	GM.	%	GM.	%	GM.	%	
Human	180		0	2.2	7	6.7	50	12.9	43	120
Cow's										
Whole	100	13	50	3.5	13	3.5	27	17.8	60	120
Lactic acid	140	6		4.8	16	5.5	41	12.9	43	120
Evaporated	70	6	80	4.8	16	5.5	41	12.9	43	120
Powdered half skimmed (Alacta)	18	11	150	6.0	20	2.2	16	19.4	64	120

Other conditions arise in which diet modification is temporarily necessary. Vomiting frequently accompanies a minor upset. This does not necessarily mean that food should be discontinued, but that the temporary decrease of total intake may be helpful. Plenty of water should be offered, and the child under no circumstances should be forced to eat. If diarrhea occurs, the food should be stopped, and water given. Feeding should be resumed slowly. The diarrhea may result from a formula too high in carbohydrate or too high in fat. In either case permanent adjustment must be made. Conversely, constipation may sometimes be corrected by increase in these food constituents.

A diet high in sugar and low in protein is a laxative diet. One low in sugar and high in protein tends to be constipating. Sugars in general have a laxative effect, some more so than others. Dex-

*J. A. M. A. 128: 283, 1945.

trose is highly fermentable but is absorbed quickly in the upper part of the intestinal tract and has, therefore, the least laxative effect. Lactose is slowly broken down, is slowly absorbed, offers the greater chance for bacterial decomposition and has the highest laxative effect. The malt sugars vary considerably, depending on their composition.

Undernourishment in an infant may be due to an ill-adjusted formula, insufficient intake, or to metabolic disturbance. Therapy consists in determining the cause and making the necessary adjustment. The overweight baby may need a decrease in fat or carbohydrate intake, or in both.

Any digestive upset which is more than transitory, and which does not clear with simple adjustment, requires the attention of the doctor to determine the basic physical cause.

Equal division of the formula into the approximate number of bottles is routine unless the child indicates a preference for more or less at any meal. Starting with six bottles of 2½ to 3 ounces each, adjustment is made in accordance with total volume and number of meals until at one year it has become 3 bottles of 8 ounces each. (For example see Table 63.)

TABLE 63

AVERAGE NUMBER OF INFANT FEEDINGS PER DAY

AGE (MONTHS)	VOLUME OF EACH FEEDING (OZ.)	NUMBER OF FEEDINGS IN 24 HOURS
1	3	6
2	4	5
4	5	5
6	6	4
8	7	4
10	8	3
12	8	3

The formula is increased in volume and strength depending on growth and satisfaction of the infant, the digestibility and utilization as indicated by consistency and number of stools and gastric effect. Approximately 50 to 100 calories will need to be added each month—or by increasing the milk approximately ½ ounce for every 5 ounces in weight gain, leaving the sugar value unchanged.

No two babies react exactly alike to the same feeding plan and no definite rules can be set up. Common sense must be used in

making adjustments. If a baby takes from choice a little more than the ounces that may have been calculated at one feeding, and a little less at another, there is no reason why he should not do so.

In the "demand feeding" schedule now being used by some pediatricians, both the time interval and the amount consumed is left entirely to the preference of the child. The child is fed when he cries—presumably because he is hungry. Usually after a few weeks a fairly constant schedule is established by the child. One child, for example, departed from the widely used 6-10-2-6-10-2 feeding program to a consistent one of 5-9-12-5-8 in the first weeks of life.

A plain milk formula should always be supplemented with orange juice and cod-liver oil from the first month.

Cod-liver oil may be given as early as the end of the first week. The amount given will depend upon the potency of the oil used; potency varies widely. One-fourth teaspoonful is approximately 1 gm. of oil and yields 1,500 U.S.P. units of vitamin A and 150 U.S.P. units, or more, of vitamin D in a good grade of oil. Dosage is preferably begun with 10 drops the first day and increased by 10 drops each day until the quarter teaspoonful dosage is reached. At two months the dosage should be slowly increased to a half teaspoonful daily; at four months to three-fourths teaspoonful; at six months it is frequently increased to a full teaspoon. The teaspoon level yields about 7,500 to 10,000 units of vitamin A and 750 to 1,000 units of vitamin D. This is roughly double the recommended need for the child.

When concentrates are used, a standardized dropper accompanies the bottle. This dropper yields approximately 50 drops to the dropper. Since concentrates are roughly 25 times as potent as the fish oil, dosage is less. Roughly, one drop is equivalent to 1,000 I.U. vitamin A and a proportionate amount of vitamin D. Dosage, therefore, is from 3 to 7 drops daily; again a gradual increase in number of drops from one to maximum desired is preferable to immediate use of the maximum amount.

Orange juice may be added at the end of the second or third week. From one teaspoonful of juice a slow increase may be made until one ounce (2 tablespoonfuls or 6 teaspoonfuls) is being given by the second month. At the third month 3 tablespoonfuls should

be given and at the fourth month 4 tablespoonfuls, etc. (see Table 64). Six tablespoons or 3 ounces, equivalent to approximately 50 mg. vitamin C, may be continued through childhood. If the juice is not well tolerated, tomato may be substituted, but twice or, better, thrice the amount must be given. Four times as much is required if pineapple juice is used. Supplementation by commercial ascorbic acid must sometimes be made if a deficiency of vitamin C is to be prevented. Too great a bulk of fruit juice may displace other dietary essentials, and this must be guarded against.

Pediatricians differ in the order in which they recommend additions to the diet, and the babies do equally well. The suggestions below represent *only one order* which may be used. Especially is this true in regard to meat and egg. The child's own need or response may also be an influencing factor.

Cereals may be given in the second or third month. Any well-cooked cereal may be used, if it is strained to remove coarse particles. Long slow cooking (1 to 1½ hours) in a double boiler top to soften the starch grains is important (see discussion under Cereals, Chapter VI). Salt should be added to the cooking water to bring out the natural sweetness of the cereal and to insure palatability without the addition of sugar. The cereal may be thinned at the time of serving with some of the formula. One teaspoonful twice daily, with gradual increase until at 5 months the baby takes one tablespoonful twice daily, at 6 months 2 tablespoonfuls twice daily, and at nine months 4 tablespoonfuls twice daily, is a satisfactory schedule of feeding.

Egg yolk. At the age of 3 months egg yolk from hard-cooked egg may be added to the baby's diet if this is the practice of the attending physician. The reason for the early inclusion of egg yolk is to compensate for the low iron content of milk, and so prevent the occurrence of anemia. Beginning with a quarter teaspoonful of egg yolk, the amount should be increased gradually until the entire yolk is taken. Or if preferred, the yolk may be made into a custard, using formula as the milk, and the custard may be fed separately or added to the formula. From 1 to 4 eggs weekly may be given during the first year.

Vegetables are usually fed at the end of the third or at the beginning of the fourth month. They should be strained until the

end of the first year. After the first year they should be served as diced vegetables. The usual directions for cooking vegetables, i.e., in a small amount of salted boiling water, should be followed. The cooking water may be used to moisten the strained vegetables. As usual, the feeding starts with one teaspoonful and is increased until 3 to 4 teaspoonfuls are taken at 6 months. Butter in small amounts may be used as seasoning. Care should be taken that new vegetables are not added to the list too rapidly. Sufficient time should be allowed between additions to make sure that no allergic response will develop from the new vegetable.

Fruit is added next. At 5 to 6 months of age a child may have cooked, strained fruit daily, apricot, peach, prune, apple, plum, or pear. Baked or mashed raw banana may be given. The amount of fruit may be increased to 3 or 4 tablespoonfuls daily by the end of the first year.

At about 7 months the child may munch on dry toast (Melba toast) or zwieback.

Meat is a matter of controversy; until recently it was usually added in small amounts at around eight months, beef, lamb, turkey, chicken, and liver, carefully broiled or roasted and finely chopped. More recently, entire meat preparations in both puréed and chopped form—beef, veal, lamb, pork, beef heart, and beef liver—have become available. These not only have been effectively used in the early months of life, but when added to the formula of the premature baby are reported to improve progress. Dr. Jeans thinks "meats appropriately prepared may be fed at any age." Again small amounts are fed at first (one teaspoonful), and one variety is fed for a sufficient length of time to rule out allergy. The amount is increased gradually until by the end of the first year one ounce—2 tbs.—is taken. Meat is alternated during the first year with egg—meat three times weekly and egg yolk four times weekly.

Thus by the end of the first year, the child's diet is complete, and further changes will be minor.

The time of weaning from the breast, as pointed out in Chapter XXII, will probably be in the third quarter of the first year, unless premature weaning is found necessary. It is desirable to wean a child directly to a cup rather than to a bottle. Alternate

breast feeding and cup feeding as a means of weaning is helpful in the establishment of future eating habits.

A feeding schedule is important for the sake of the mother's routine and habit formation in the child. However, adherence to any rigid schedule in the early weeks of life is being abolished by many pediatricians. The child who is allowed to adjust his preferences in time and amount, rather than having these set forth for him, is usually the happier child. In the first weeks of life the child will usually be fed approximately every four hours around the clock. On a four-hour schedule the time for feeding is usually 2, 6, and 10 o'clock in the morning, and 2, 6, and 10 o'clock in the latter half of the day. *The actual schedule will depend on the convenience of the mother and the preference of the child. The baby must not disrupt the family life; he should take his place and add to the family's pleasure.* For the sake of convenience, however, such a time plan will be followed here.

By the end of the first month, or perhaps the second, the feeding coming at 2 o'clock in the morning is omitted. This may be done as soon as a satisfactory weight gain is established. Most children will voluntarily omit this meal once the need for it ceases. Near the end of six months the 10 o'clock feeding at night may be omitted, depending on the condition or the desire of the child.

Cod-liver oil may be given after any of the feedings, first as one dose, and later when the amount is increased, as two doses if desired.

Orange juice is usually given between meals, at about 8 o'clock in the morning. It may be given alone or it may be diluted slightly with water if desired. For some babies it may be wiser to give the orange as part of a meal, instead of on an empty stomach. Some babies are apparently sensitive to the organic acidity of the undiluted orange juice and may "spit it up." Also, as with other foods, allergy may be present.

The cereal, when added, is fed at 10 A.M. and, later, as more is given, also at 6. P.M. The vegetables and egg or meat are added at 2 P.M., and thus the egg and vegetables become the forerunner of a noon dinner. The fruit next increases the supper meal at 6 P.M., and the basis for the three meals a day is at last established.

TABLE 64

To tabulate the foregoing, for convenience, the menu *might* be:

At 4 Months of Age

6 A.M.	6 oz. milk
8 A.M.	2 oz. orange juice
10 A.M.	1 tbs. cereal
	6 oz. milk
	cod-liver oil
2 P.M.	egg yolk or vegetable
	6 oz. milk
6 P.M.	6 oz. milk
10 P.M.	6 oz. milk

At 6 Months of Age

6 A.M.	7-8 oz. milk
8 A.M.	2 oz. orange juice
10 A.M.	1 tbs. cereal
	7-8 oz. milk
	cod-liver oil
2 P.M.	3 tbs. vegetable
	egg yolk
	7-8 oz. milk
6 P.M.	1 tbs. cereal
	7-8 oz. milk
	1 tbs. fruit
	cod-liver oil

At 10 to 12 Months of Age

7-8 A.M.	2-3 tbs. cereal served with part of milk—balance of 8 oz. served in cup
Noon	2 tbs. meat
	2-3 tbs. vegetable
	2-3 tbs. simple pudding
	piece crisp toast
	8 oz. milk
Mid P.M.	3 oz. orange juice with cracker
5:30-6:30 P.M.	3 tbs. cereal (or vegetable soup)
	3 tbs. fruit
	8 oz. milk

The fish oil or concentrate may be given at any convenient time.

Exact quantities of food cannot be planned to meet the child's appetite. Judgment must be used in quantity of serving. A normal, healthy child will satisfy himself within a reasonable time limit without force or coaxing, if moderate quantities of mildly

TABLE 65

ANOTHER SCHEDULE WHICH MAY BE FOLLOWED IN FEEDING NORMAL INFANTS DURING FIRST YEAR

AGE, MO.	0	1	2	3	4	5	6	7	8	9	10	11	12
Wt., gm.	3,400	3,850	4,750	5,730	6,450	6,900	7,450	7,800	8,150	8,370	8,700	9,050	9,530
Milk, % wt.	14	14	14	13.6	13	12.5	12.3	12.1	12				
Milk, c.c.	450	540	660	780	840	870	900	945	1,000	1,000	1,000	1,000	1,000
Karo, c.c.	22	27	33	39	41	43	30	15	0	0	0	0	0
Calories	395	475	585	685	737	760	--	--	--	--	--	--	953
Cal./kg.	115	123	123	120	115	110	--	--	--	--	--	--	100
Milk, oz.	15	18	22	26	28	29	30	31	32	32	32	32	32
Karo, tbs.	1½	2	2¼	2½	3	3	2	1	0	0	0	0	0
Cal./lb.	53	55	55	54.5	52	50	--	--	--	--	--	--	45
Wt. lb.	7.5	8.5	10.5	12.7	14.2	15.2	16.5	17.2	18	18.5	19.2	20	21

Cod-liver oil ¼ tsp.---- ½ tsp.----------- ¾ tsp.-------- 1 tsp.--

Orange juice or double tomato juice 1 tbs.---- 2 tbs.-- 3 tbs.-- 4 tbs.---------5 tbs.------6 tbs.----------------------------

Egg yolk ¼ tsp.---------- ½ tsp.---- entire yolk--

Cereals 1 tsp. × 2, 2 tbs. × 2-----4 tbs. × 2------------------------

Vegetables 1 tsp. up to 4 tsp.-------2 tbs.------------------------------

Strained fruit 1 tbs. × 1-----2 tbs.--------- 3 tbs.------- 4 tbs.

Toast 1 piece --------------------------------

Meat Inclusion date optional. Can be added in puréed form as early as first month. It probably should be added by six or seven months.

but palatably seasoned, reasonably attractive food is served at the proper temperature. Fussiness over quality of food is undesirable, but the child is entitled to good meals. He will learn to like more foods if care is used in their preparation.

Coaxing a child to eat is psychologically bad and should not become a habit.

At the end of the first year the child, on a three meal a day schedule, should be taking his vegetables, fruits, and cereals unstrained; he should be eating dry toast, meat, and egg, and drinking milk, orange juice, and water from a cup.

Water, boiled and cooled, should be offered between meals throughout the day, especially if the day is warm.

The problem of infant and child feeding is an ever present one and one upon which many have written. One of the most logical dissertations heard on the subject was by Dr. Aldrich when he talked about "Ancient Processes in a Scientific Age." He discussed the effect of the impact of the new techniques in baby care on the child's ancient mechanism, for in the newborn child is a living replica of the first individual born so many centuries ago. In the "training" process the child is under the compulsion of two forces. The first is the drive to grow according to his preordained pattern—physically, emotionally, and mentally. The second is the authoritative routines of a scientific age which, among other things, tell the child when and how much to sleep and to eat. This frequently results in conflicts which are not really the baby's fault.

The newborn baby is born with reflexes which are concerned with the actual getting of food—rooting, sucking, swallowing, and satiety reflexes. The first reflex to come into play is the one which causes the child to root—to move his head when he smells food in an effort to find its source. If one cheek is touched by a smooth object he will turn his mouth toward that object and open it in anticipation of grasping the food. Pressure applied to a baby's head in an effort to guide him immediately to the nipple invariably results in resistance and frequently arouses a feeling of displeasure in the child. To add to his discomfort, it may seem necessary to "rouse" him by any of the little tricks used for that purpose. Most newborn babies are drowsy as an aftereffect of the sedation administered to the mother. All of

this takes place at a time suited to his planned program, not his desire for food. Hence, a pleasurable connection between hunger and the ingestion of food may not immediately develop as Nature intended it should be. If for the first few days of life it is possible to permit the child to eat in response to hunger, to let him root for his own food, even though he dozed a bit, a worth-while association between hunger, eating, and pleasure might be developed. Once this is established, it would take but a few more days to gradually introduce a routine.

The hunger-appetite mechanism fares differently in the modern hospital or under a "scientific" regime. The baby's rhythmic hunger pains are completely ignored in his schedule for feeding. As Dr. Aldrich expresses it, the newborn baby who wakes up with a stomach-ache and announces his epigastric crisis by shrieking cries does not meet with the response Nature intended for him. Instead of being picked up and given something to eat, too frequently he is forced to wait until the clock on the wall moves around to the approved hour, at which time, sleeping or screaming, he is picked up and made to eat. A slow transition from the natural way to a set program may prevent later feeding problems. Once the happy association is established between hunger and food, and between eating and food, it will carry over into later life.

By careful watching rather than by date, the child should be introduced to thick foods. When the lips open and the tongue actively takes nourishment back so that swallowing is easy, is the logical time to offer foods which are of thicker consistency than milk. When the child makes chewing motions, lumpy or solid foods should be given—not before and not later.

If a mother observes her child carefully and intelligently, she will find that automatically, if he is well, he will sleep through first his 2 A.M. and then his 10 P.M. feeding; and he will shift his nap time from morning to afternoon at just about the accepted time to go over onto the three-meal schedule. To let these readjustments be natural ones is certainly preferable to forcing a change prematurely. Babies, Dr. Aldrich contends, are accommodating sort of persons and adjust readily if permitted to do so in a logical, natural manner.

Review Questions

What are the advantages of breast feeding over formula feeding of infants?

Why is sugar in some form added to milk in artificial feeding?

What advantages does evaporated milk have in contrast to fresh milk in formula making?

What supplementations does any milk formula require? At what age are these supplements added?

At what age are the first solid foods given?

In introducing solid foods, what precaution should be taken?

At what age should a baby receive a full quart of milk daily?

What may be said in regard to a rigid schedule of feeding vs. a more lenient one of eating in response to hunger?

What factors should govern additions to the infant diet?

How does the metabolic rate of the infant compare with the adult?

How does the protein requirement compare? Why?

CHAPTER XXIV

FOOD FOR CHILDREN

Ideas about the feeding of children have undergone many changes in the last few years. Today the diet of the young child contains cereal, vegetable, fruit, egg, and meat, in addition to milk. The difference in the diets of young and older children is in the amount rather than in the kind of food. This is fortunate since good nutrition is more easily attained on a well-chosen variety of food than on a limited choice. Also better food habits may be established early in life. The child who has had an abundance of the right kind of food is sturdy, alert, and happy. He is active, has a good appetite, and makes a consistent weight gain.

Small children all too readily imitate adults and older children. Eating habits are not inherited. Fussiness about eating usually develops only after the child becomes conscious of the eating habits of others or of the reaction to his food of the person feeding him. Undesirable eating habits must not be allowed to develop. Most children will eat if they are really hungry, although sometimes they have to be very hungry before they will eat without coaxing. If plenty of water is given, a child may go safely twenty-four, or even forty-eight, hours without food, and it is better that he should than that the mother should forever coax or bribe him to eat. Consistency, firmness, and calmness must mark the mother's attitude. No concern should be shown over a child's refusal to eat. All too often this is merely a bid for attention. The quiet removal of a meal at the end of a reasonable time, and the withholding of all food except water until the next mealtime is the wise solution and is a kindness to the child. Borgeson suggests that "watchful neglect" of the child, a pleasing atmosphere with social conversation, the serving of small portions with the expectation that they will be eaten, the pairing of disliked food with liked foods and a good adult example are factors in stimulating good eating habits in children. Eating a meal is an important thing, and the child must not be distracted, especially when he is first laboring with his own utensils. When his eating habits are established, and

only then, should he be given his food at the family table. Food requirements for normal growth and development are greater in proportion for the child than for the adult. The child must grow, maintain his body temperature, and produce ample energy for his endless activities.

Jeans, in his *Essentials of Pediatrics,* summarizes the approximate protein and energy requirements of children in Table 66.*

TABLE 66

AGE IN YEARS	APPROX. HT. IN IN.	APPROX. WT. IN LB.	AVG. PROTEIN IN GM.	AVG. OF TOTAL CALORIES
1	30	22	30	1,000
2	34	27	32	1,100
3	37	32	35	1,250
4	40	36	37	1,375
5	43	41	41	1,500
6	46	48	48	1,600
7	48	52	52	1,750
8	50	58	58	1,900
9	52	64	64	2,050
10	54	71	71	2,200
11	56	78	78	2,400
12	58	87	87	2,600
13	60	95	95	2,800
14	63	110	100	3,000
15	65	120	100	3,300
16	67	130	100	3,500

Because of the rapid growth rate in the child, his protein requirement on a comparable weight basis, as indicated above, is higher than for the adult. The child doubles his birth weight in 5 months; at 1 year his weight has increased to 3 times, at 2 years to 4 times, at 6 years to 7 times the birth weight. During his preschool years he will gain approximately 5 pounds per year and grow 3 inches per year.

In early years the protein intake should be at a level of 3 to 4 gm. per kilogram of body weight, or should supply roughly 10 to 15 per cent of the total calories. This protein should be of high biological value. Milk is the protein of first choice. The child's diet should continue to contain the liberal amounts of milk which had been included in his diet during infancy. (From 1½ pints to 1 quart per day, see Normal Diet.) If this proves to be too great in bulk, the use of powdered milk added to the smaller amount of fluid milk, or the use of powdered milk in

*Reproduced with the permission of J. B. Lippincott Company.

cooking, may be resorted to. The continued use of egg and meat will supply adequately the remainder of animal protein. This will be supplemented by cereals to make up the required amount.

Fig. 69.—Meals for the 3-year-old child. (Courtesy of Bureau of Home Economics, United States Department of Agriculture.)

The fat level will be somewhat higher than in the adult diet, due to greater caloric need in proportion to bulk. Fat may supply up to 40 per cent of the total calories in the diet.

At the end of the first year, the child's food schedule shifts to conform more nearly to that of the adult. A breakfast of cereal, fruit, and milk, between 7:00 and 8:00 o'clock; a noon dinner of

Fig. 70.—The same menu for all. (Courtesy of Bureau of Home Economics, United States Department of Agriculture.)

meat, vegetables, toast, and a simple dessert, such as custard, tapioca, or cornstarch pudding, junket; a midafternoon lunch of a drink of milk or fruit juice, and a cracker at 3:00 o'clock;

TABLE 67

FOOD	AMOUNT NEEDED BY EACH CHILD DAILY	AVERAGE SIZE OF SERVING FOR EACH AGE		
		1 YEAR	2 AND 3 YEARS	4 AND 5 YEARS
Milk	3 to 4 cups	1 Cup as a drink at each meal		
Eggs	1 egg	1 whole egg		
Meat, poultry, or fish	½ to 2 oz. (1 to 4 tbs.)	1 oz. (2 tbs.)	1½ oz. (3 tbs.)	2 oz. (4 tbs.
Dried beans, peas, lentils	1 serving 2 or 3 times a week when meats and eggs are hard to get	Strained in soup	3 tbs.	4 tbs.
Potatoes	1 serving	2 tbs.	3 tbs.	4 tbs.
Other cooked vegetables (a green leafy or deep-yellow vegetable often)	1 to 2 servings	2 tbs.	3 tbs.	4 tbs.
Raw vegetables (lettuce, carrots, celery, tomatoes, etc.)	Small amount		A small piece, or two	
Fruit for vitamin C	1 medium-sized orange or ½ to ¾ cup tomato juice	Whole day's amount in one serving		
Other fruit (apple, banana, peaches, prunes)	1 to 2 servings	¼ cup	⅓ cup	½ cup
Cereal, whole-grain, restored, or enriched	1 serving	¼ cup	⅓ cup	½ cup
Bread, whole-grain or enriched	1½ to 4 slices	½ to 1 slice	1 to 1½ slices	2 to 4 slices
Butter or fortified margarine	1 to 2 tbs.	1 tsp.	1 to 3 tsp.	1 to 3 tsp.
Sweets	A simple dessert at 1 or 2 meals	¼ cup	⅓ cup	½ cup
Fish-liver oil	Enough to provide 400 to 800 U. S. P. units of vitamin D*			

All measurements in this chart are level, measuring cups and measuring spoons being used.

*For approximate amounts of vitamin D in different preparations see Substitutes for the Sun (Children's Bureau Folder 25, Washington, 1940).

and a light supper at 6:00 o'clock, consisting of cereal or cream soup, and fruit, is now the well-chosen routine. This scheme of diet continues throughout the second year, or it may be increased to provide a heartier breakfast by the inclusion of an egg (a whole egg now) or bacon, or both egg and bacon if desired. It is highly desirable that a citrus fruit continue to be one of the daily fruits.

In fact, this is the diet plan which should be followed throughout childhood, and it should fit readily into the diet plan of the family. The slogan of the busy mother should be "one menu for all." It is a matter of increasing quantity of food intake rather than changes in type of food which should be continued throughout childhood, with the exception of fried foods, tea, coffee, and rich desserts which, after all, should be used in only limited amounts in any dietary.

TABLE 68

RANGE OF AVERAGE WATER REQUIREMENTS OF CHILDREN AT DIFFERENT AGES UNDER ORDINARY CONDITIONS

AGE	BODY WT. IN KG.	TOTAL WATER IN 24 HR.	WATER KG./24 HR.
3 days	3.0	240- 300	80-100
10 days	3.2	400- 480	125-150
3 months	5.4	750- 864	140-160
6 months	7.3	950-1,130	130-155
9 months	8.6	1,075-1,240	125-145
1 year	9.5	1,140-1,300	120-135
2 years	11.8	1,350-1,475	115-125
4 years	16.2	1,600-1,800	100-110
6 years	20.0	1,800-2,000	90-100
10 years	28.7	2,000-2,440	70- 85
14 years	45.0	2,250-2,700	50- 60
18 years	54.0	2,160-2,700	40- 50

In the Children's Bureau booklet "Your Child From One to Six," an outline is suggested for foods to be included in a good daily diet for children from 1 to 6 years of age (Table 67).

The water intake in early childhood continues to be of importance. In the White House Conference Report on nutrition the amounts in Table 68 are suggested.

The diet for children and the diet for a convalescent (adult or child) are identical.

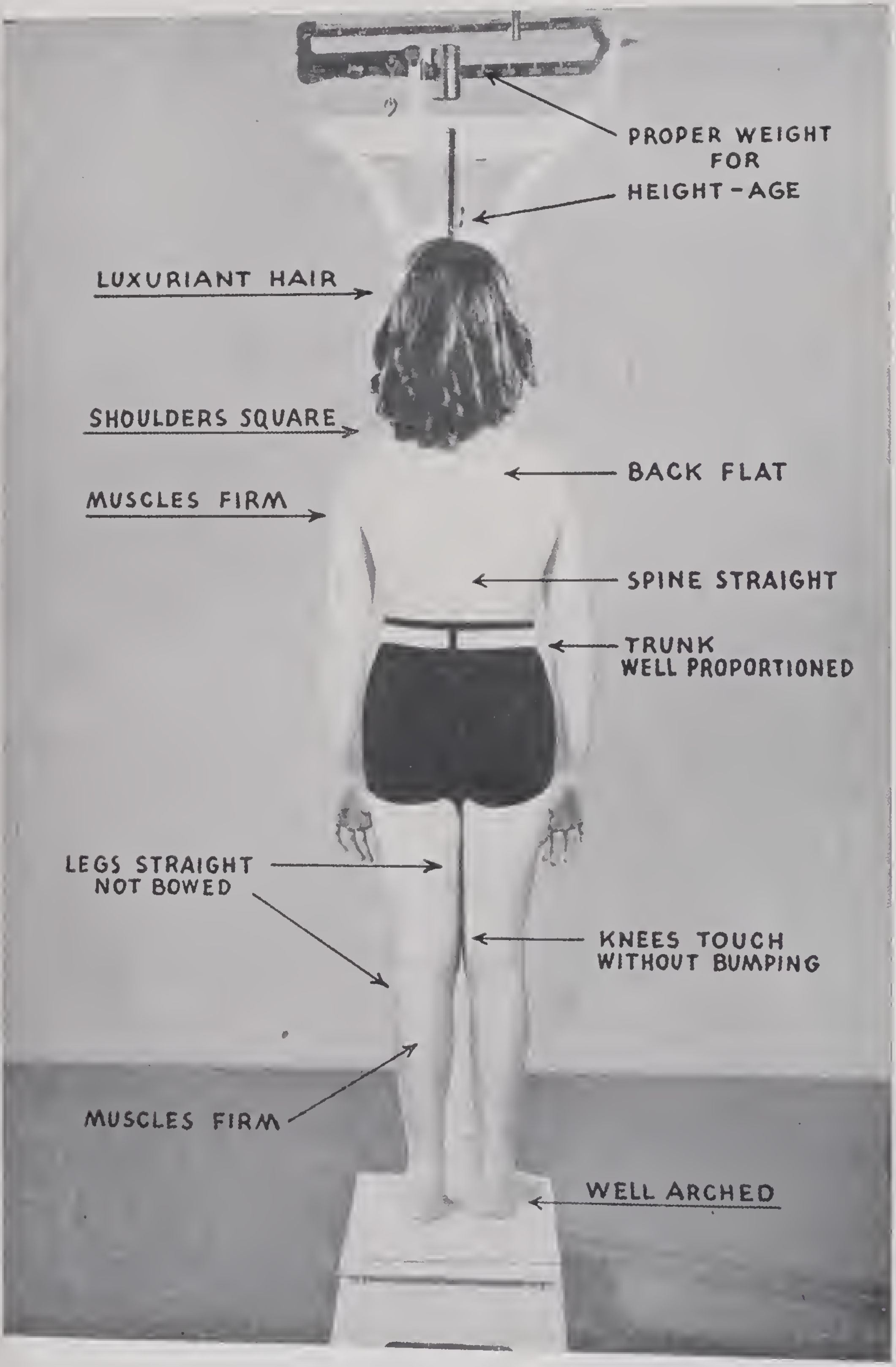

Fig. 71.—The healthy child. (Courtesy of the California Fruit Growers Exchange.)

In lieu of more accurate standards tables for height and weight for age, with due consideration for racial and familial characteristics, are used as the criterion for good nutrition. Other characteristics are, however, of importance, and must be kept in mind (see Evaluation of Nutritional Status, Chapter XX).

Height-weight tables, based on age and sex, are given in Tables 69, 70, 71, 72, and 73.

TABLE 69

WEIGHT-HEIGHT-AGE TABLE FOR GIRLS

From Birth to School Age

HEIGHT (INCHES)	1 MO.	3 MO.	6 MO.	9 MO.	12 MO.	18 MO.	24 MO.	30 MO.	36 MO.	48 MO.	60 MO.	72 MO.
20	8											
21	9	10										
22	10	11										
23	11	12	13									
24	12	13	14	14								
25	13	14	15	15								
26		15	16	17	17							
27		16	17	18	18							
28			19	19	19	19						
29			19	20	20	20						
30			21	21	21	21	21					
31				22	22	23	23	23				
32					23	24	24	24	25			
33						25	25	25	26			
34						26	26	26	27			
35						29	29	29	29	29		
36							30	30	30	30	31	
37							31	31	31	31	32	
38								33	33	33	33	
39								34	34	34	34	34
40									35	36	36	36
41										37	37	37
42										39	39	39
43										40	41	41
44											42	42
45												45
46												47
47												50
48												52

Prepared by Robert M. Woodbury, Ph.D., Children's Bureau, U. S. Department of Labor, 1923.

Weight is stated to the nearest pound; height to the nearest inch; age to the nearest month.

Weights of children under 35 inches were taken without clothing; those of children above 35 inches with clothing (shoes, coat, and sweater removed).

Published by American Child Health Association, 50 West Fiftieth Street. New York.

TABLE 70

WEIGHT-HEIGHT-AGE TABLE FOR BOYS

From Birth to School Age

HEIGHT (INCHES)	1 MO.	3 MO.	6 MO.	9 MO.	12 MO.	18 MO.	24 MO.	30 MO.	36 MO.	48 MO.	60 MO.	72 MO.
20	8											
21	9	10										
22	10	11										
23	11	12	13									
24	12	13	14									
25	13	14	15	16								
26		15	17	17	18							
27		16	18	18	19							
28			19	19	20	20						
29			20	21	21	21						
30			22	22	22	22	22					
31				23	23	23	23	24				
32				24	24	24	25	25				
33					26	26	26	26	26			
34						27	27	27	27			
35						29	29	29	29	29		
36							30	31	31	31		
37							32	32	32	32	32	
38								33	33	33	34	
39								35	35	35	35	
40									36	36	36	36
41										38	38	38
42										39	39	39
43										41	41	41
44											43	43
45											45	45
46												48
47												50
48												52
49												55

Prepared by Robert M. Woodbury, Ph.D., Children's Bureau, U. S. Department of Labor, 1923.

Weighing children is a means of ascertaining their rate of growth. All children should make a regular annual gain. Tables 26 to 29 should be used as a means of interesting parents in their children's growth.

Lay infant on table on which has been placed an accurate measure. Stand child with heels and shoulders against a wall upon which has been marked or pasted an accurate measure.

Encourage the annual physical examination of every child by a physician.

TABLE 71

WEIGHT-HEIGHT-AGE TABLE FOR GIRLS

HEIGHT INCHES	5 YR.	6 YR.	7 YR.	8 YR.	9 YR.	10 YR.	11 YR.	12 YR.	13 YR.	14 YR.	15 YR.	16 YR.	17 YR.	18 YR.
38	33	33												
39	34	34												
40	36	36	36											
41	37	37	37											
42	39	39	39											
43	41	41	41	41										
44	42	42	42	42										
45	45	45	45	45	45									
46	47	47	47	48	48									
47	49	50	50	50	50	50								
48		52	52	52	52	53	53							
49		54	54	55	55	56	56							
50		56	56	57	58	59	61	62						
51			59	60	61	61	63	65						
52			63	64	64	64	65	75						
53			66	67	67	68	68	67	71					
54				69	70	70	71	69	73					
55				72	74	74	74	71	77	78				
56					76	78	78	79	81	83				
57					80	82	82	82	84	88	92			
58						84	86	86	88	93	96	101		
59						87	90	90	92	96	100	103	104	
60						91	95	95	97	101	105	108	109	111
61							99	100	101	105	108	112	113	116
62							104	105	106	109	113	115	117	118
63								110	110	112	116	117	119	120
64								114	115	117	119	120	122	123
65								118	120	121	122	123	125	126
66									124	124	125	128	129	130
67									128	130	131	133	133	135
68									131	133	135	136	138	138
69										135	137	138	140	142
70										136	138	140	142	144
71										138	140	142	144	145

Prepared by Bird T. Baldwin, Ph.D., and Thomas D. Wood, M.D.

When taking measurements, remove the child's outdoor clothing, shoes, and coat. Take heights with a square, consisting of two flat pieces of wood joined at right angles (a chalk box will serve). The child is placed in a good erect position, with heels and shoulders against the wall or wide board, upon which has been marked or pasted an accurate measure. Age is taken to the nearest birthday.

Published by The American Public Health Association, 50 West Fiftieth Street, New York, N. Y.

TABLE 72

WEIGHT-HEIGHT-AGE TABLE FOR BOYS

HEIGHT INCHES	5 YR.	6 YR.	7 YR.	8 YR.	9 YR.	10 YR.	11 YR.	12 YR.	13 YR.	14 YR.	15 YR.	16 YR.	17 YR.	18 YR.	19 YR.
38	34	34													
39	35	35													
40	36	36													
41	38	38	38												
42	39	39	39	39											
43	41	41	41	41											
44	44	44	44	44											
45	46	46	46	46	46										
46	47	48	48	48	48										
47	49	50	50	50	50	50									
48		52	53	53	53	53									
49		55	55	55	55	55	55								
50		57	58	58	58	58	58	58							
51			61	61	61	61	61	61							
52			63	64	64	64	64	64	64						
53			66	67	67	67	67	68	68						
54				70	70	70	70	71	71	72					
55				72	72	73	73	74	74	74					
56				75	76	77	77	77	78	78	80				
57					79	80	81	81	82	83	83				
58					83	84	84	85	85	86	87				
59						87	88	89	89	90	90	90			
60						91	92	92	93	94	95	96			
61							95	96	97	99	100	103	106		
62							100	101	102	103	104	107	111	116	
63							105	106	107	108	110	113	118	123	127
64								109	111	113	115	117	121	126	130
65								114	117	118	120	122	127	131	134
66									119	122	125	128	132	136	139
67									124	128	130	134	136	139	142
68										134	134	137	141	143	147
69										137	139	143	146	149	152
70										143	144	145	148	151	155
71										148	150	151	152	154	159
72											153	155	156	158	163
73											157	160	162	164	167
74											160	164	168	170	171

Prepared by Bird T. Baldwin, Ph.D., and Thomas D. Wood, M.D.

These tables were constructed from measurements made on a group of presumably healthy children, most of whom are native born. They show the *average* weight for height and age and sex. *Individual* children of the same age and height *normally* show wide variation in weight due principally to the width and depth of the skeletal framework. Body width and depth are as important as height in determining body weight. This fact should be kept in mind in interpreting the *significance* of deviation from average weight for height. Weight for height alone is not a dependable index of nutritional status. (February, 1932.)

Somewhat better criteria are the growth study figures obtained at the University of Iowa, shown in Table 73.

Fig. 72.—The process of good nutrition is a continuous one; the nutrition of a child at any period in life is dependent on that of all preceding ones. The difference in body build shown by these girls is not related to age or to nutrition. All three are 8 years old and all are well nourished. Photograph by Bureau of Human Nutrition and Home Economics (BHNHE) of the United States Department of Agriculture (USDA).

TABLE 73

A STUDY OF GROWTH

At the present time average *gain in weight,* rather than so-called *normal weight,* is considered of primary importance in studying the health of boys and girls of school age.

By consulting the table showing range of height, the student may first decide whether he is classified as short, medium, or tall. Studying the second table he will see approximately what his annual gain in weight should be.

GAIN IN HEIGHT AND WEIGHT BY YEARS FOR **BOYS** OF SCHOOL AGE

Range of Height of Short, Medium, and Tall Boys

	Age, Years												
	6	7	8	9	10	11	12	13	14	15	16	17	18
	Height, Inches												
Short—													
Less than	43.5	45.5	47.5	49.5	51.5	53.5	54.5	56.5	59.0	61.0	63.0	65.0	66.0
Medium—													
From	43.5	45.5	47.5	49.5	51.5	53.5	54.5	56.5	59.0	61.0	63.0	65.0	66.0
To	48.4	50.4	52.4	54.4	56.4	58.4	60.4	62.9	65.9	68.4	69.9	70.9	71.4
Tall—													
More than	48.4	50.4	52.4	54.4	56.4	58.4	60.4	62.9	65.9	68.4	69.9	70.9	71.4

These values have been rounded to the nearest 0.0 or 0.5.

Annual Gain in Mean Weight of Short, Medium, and Tall Boys

	Age, Years											
	6-7	7-8	8-9	9-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18
	Gain, Pounds											
Short	2	3	6	6	6	3	8	9	10	11	13	8
Medium	5	5	6	6	6	6	9	13	12	12	7	5
Tall	6	7	6	8	8	10	11	15	12	6	6	7

GAIN IN HEIGHT AND WEIGHT BY YEARS FOR **GIRLS** OF SCHOOL AGE

Range of Height of Short, Medium, and Tall Girls

	Age, Years												
	6	7	8	9	10	11	12	13	14	15	16	17	18
	Height, Inches												
Short—													
Less than	43.5	45.5	47.5	49.0	50.5	52.5	54.5	57.5	59.5	60.5	61.5	61.5	61.5
Medium—													
From	43.5	45.5	47.5	49.0	50.5	52.5	54.5	57.5	59.5	60.5	61.5	61.5	61.5
To	47.4	49.4	51.9	54.4	56.4	58.4	60.9	63.4	64.9	65.4	65.9	65.9	65.9
Tall—													
More than	47.4	49.4	51.9	54.4	56.4	58.4	60.9	63.4	64.9	65.4	65.9	65.9	65.9

These values have been rounded to the nearest 0.0 or 0.5.

Annual Gain in Mean Weight of Short, Medium, and Tall Girls

	Age, Years											
	6-7	7-8	8-9	9-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18
	Gain, Pounds											
Short	4	4	4	5	6	6	12	12	9	8	1	1
Medium	5	6	6	6	7	9	14	9	7	4	2	1
Tall	6	8	9	8	11	13	12	7	4	4	1	1

From studies done at the University of Iowa. Tabulated by Massachusetts Department of Public Health. Distributed by Maltex Company, Inc., Burlington, Vermont.

Review Questions

How does the diet of a two-year-old child compare with that of an infant of one year?

Should the diet of young children differ from that of the adults in a family?

What responsibility have parents and other adults in a family in forming correct eating habits in children?

How do the food requirements of children compare with those of adults in protein content? Fat? Carbohydrate?

Why are proteins of high biological value necessary in a child's diet for good nutrition?

What items should be omitted from children's diets?

Is water important?

CHAPTER XXV

DIET AND THE TEETH

Dental caries is widespread and is a menace to be reckoned with. The cause of this condition is, however, debated. As one examines experimental reports and surveys, the evidence appears contradictory. However, since the incidence of caries is apparently associated with health habits (nutrition and hygiene), it behooves us to establish habits which *should* result in optimum tooth health, even though there may not be definite proof that any particular factor will be effective in itself. The relationship between soundness of teeth and general health is well known; hence the problem of tooth decay is not merely localized in the mouth. The fact that laboratory animals can be made to show tooth decay on deficient diets, and the fact that diabetic children who live on essentially ideal diets have a lower incidence of caries than do nondiabetic children, suggest that nutrition is an important factor at least during the early years of life when tooth formation is taking place.

On the side of the nutritional theory many experiments have been carried out. The tooth is now believed to be a living structure and as such must have adequate nourishment for growth. Any wide departure from an adequate diet appears to be reflected in tooth health, or "tooth setting," since the surrounding gum tissue must be considered with the teeth proper.

The tooth buds for the first teeth are distinguishable at the eighth week of prenatal life. By the time the child is born, the sixth year molars (the first of the permanent teeth to be erupted) are beginning to calcify. Hence it is obvious that if teeth are to be perfectly developed, structural material for them must be adequate during prenatal life. If this material is not supplied by the mother's food, her body stores will be called upon, to the distinct disadvantage of the tissues of the mother or the tooth development of the child. Mellanby showed that in dogs the improper feeding of the mother during pregnancy had a deleterious influence upon the tooth structure of the young. The work also shows clearly that a diet which will produce rickets also tends

to interfere with proper calcification and enameling of the teeth. Pregnant sows, on the other hand, were found by Klein, McCollum, Buckley, and Howe to make sufficient sacrifice of their own reserves to insure normal teeth to the young at birth. This drain on the

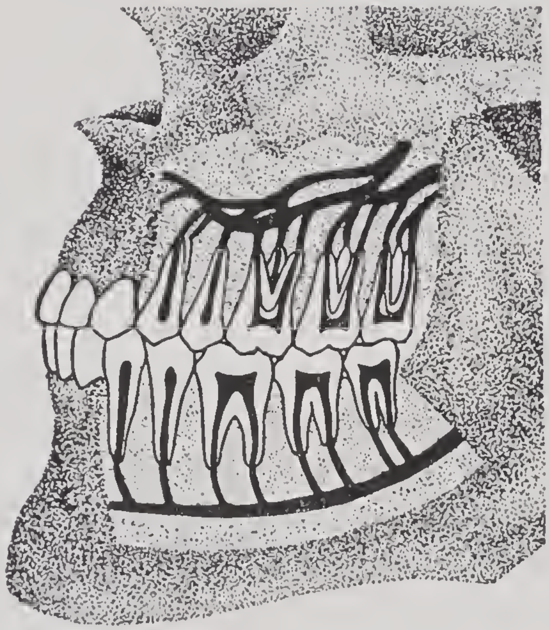

Fig. 73.—Relation of blood supply to structure of the teeth. The black lines represent the blood stream which supplies the teeth with food. (From *If Food Could Talk,* Cornell University Bulletin J-44.)

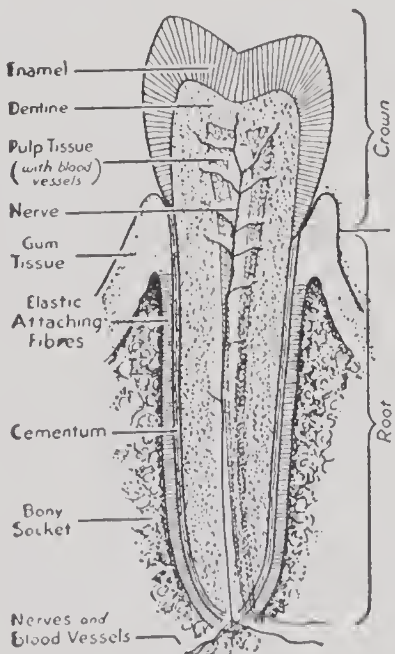

Fig. 74.—Cross section of a tooth. Each tooth is composed of three parts; the crown above the gumline, the roots below, and the neck where crown and roots meet. The crown is covered with enamel, the hardest material in the body, and the roots are covered with a thin layer of bonelike material called dentine, which lies underneath these outer coverings. Enclosed with the dentine is a hollow space called the pulp chamber, where the life of the tooth is maintained. (Courtesy of the Metropolitan Life Insurance Company.)

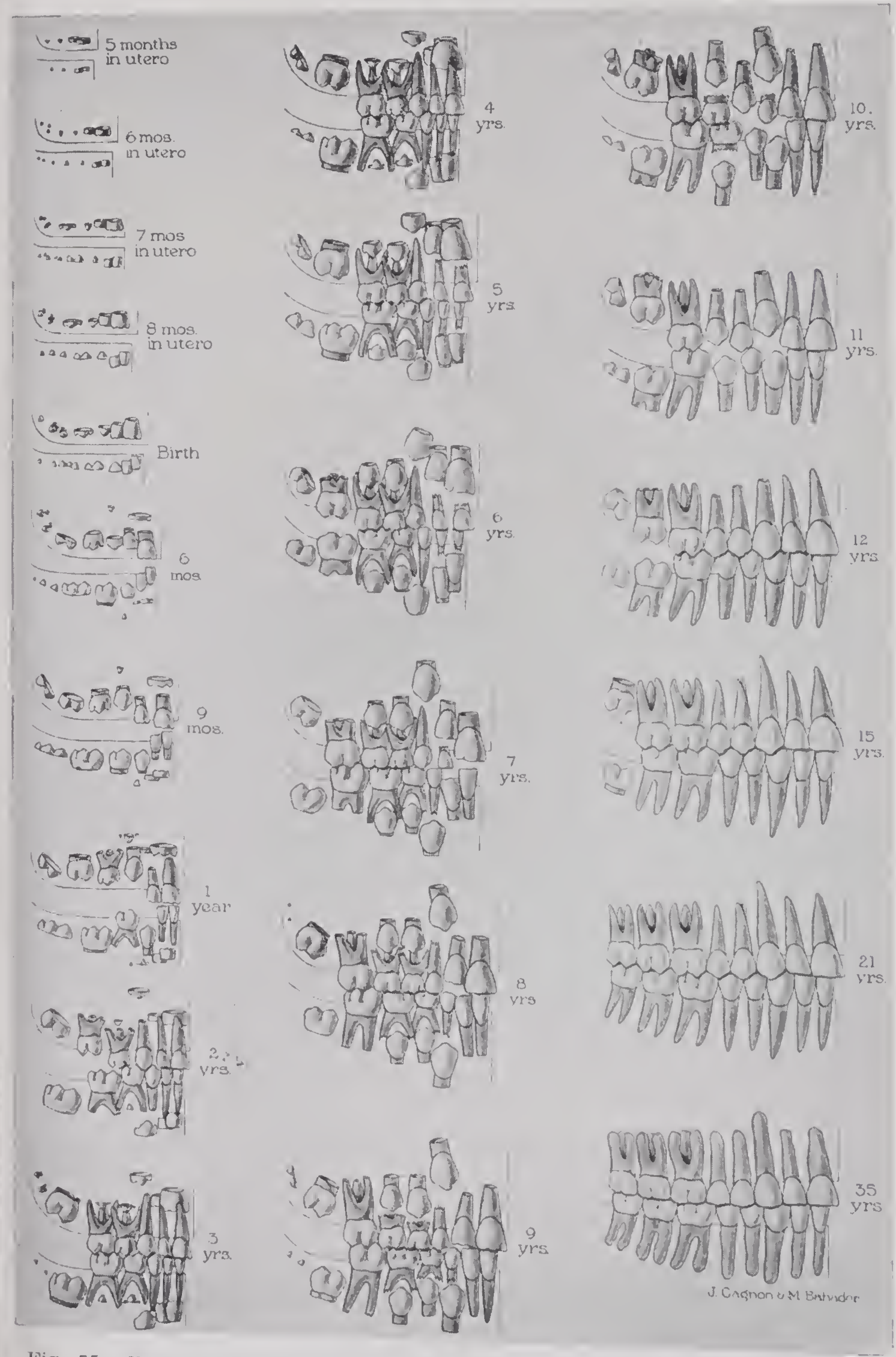

Fig. 75.—Development of the human dentition. (Courtesy Dr. I. Schour and Dr. M. Massler, University of Illinois, College of Dentistry.)

mother's tissues continued through lactation. It must be remembered in this connection that the average diet, even though containing adequate amounts of milk, meat, eggs, fruits, and vegetables, is low in vitamin D (see Vitamin D, in Chapter X).

Specific dietary deficiencies have been shown to result in specific changes in the teeth, as indicated by vast data which have been accumulated. Vitamins A, the B group, and C, in addition to vitamin D, as well as calcium and phosphorus are shown to be essential for development of normal tooth structure, but not in amounts greater than those ingested in the normal adequate diet, with the exception of vitamin D.

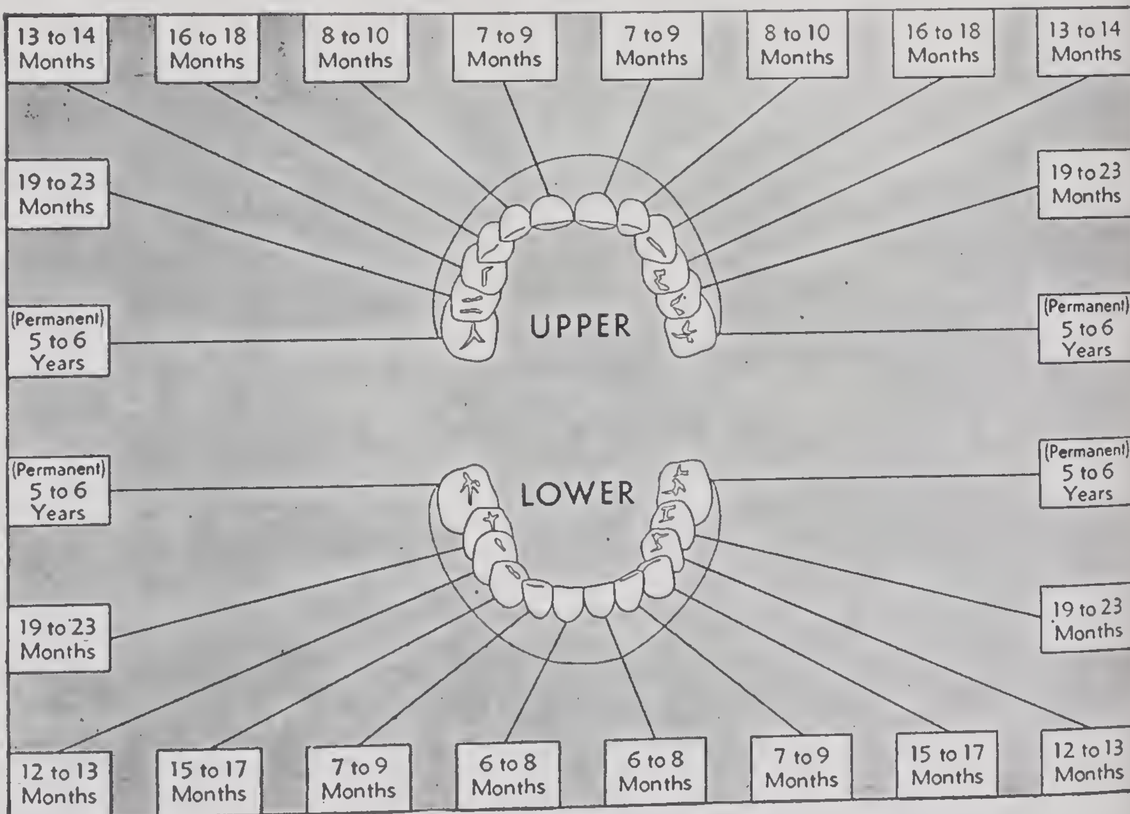

Fig. 76.—Baby's first teeth. (Courtesy of the California Fruit Growers Exchange.)

In an article *Health Organization—League of Nations* in the Quarterly Bulletin, June, 1935, it is stated: "It would be cheaper to supply school children regularly with vitamin D in some form than to supply them with dental treatment—treatment which, for the most part, consists in an attempt to repair the ravages of already existent caries. This is a question which merits the closest attention on the part of public health authorities."

Boyd suggests that since tooth decay can be reduced to a negligible level by controlling the diet of children, the eating habits of the public should be altered. He feels that great strides could thereby be made in dental response. Health habits, coupled with a carefully planned diet during pregnancy and with an adequate diet at other times, could give future generations better teeth.

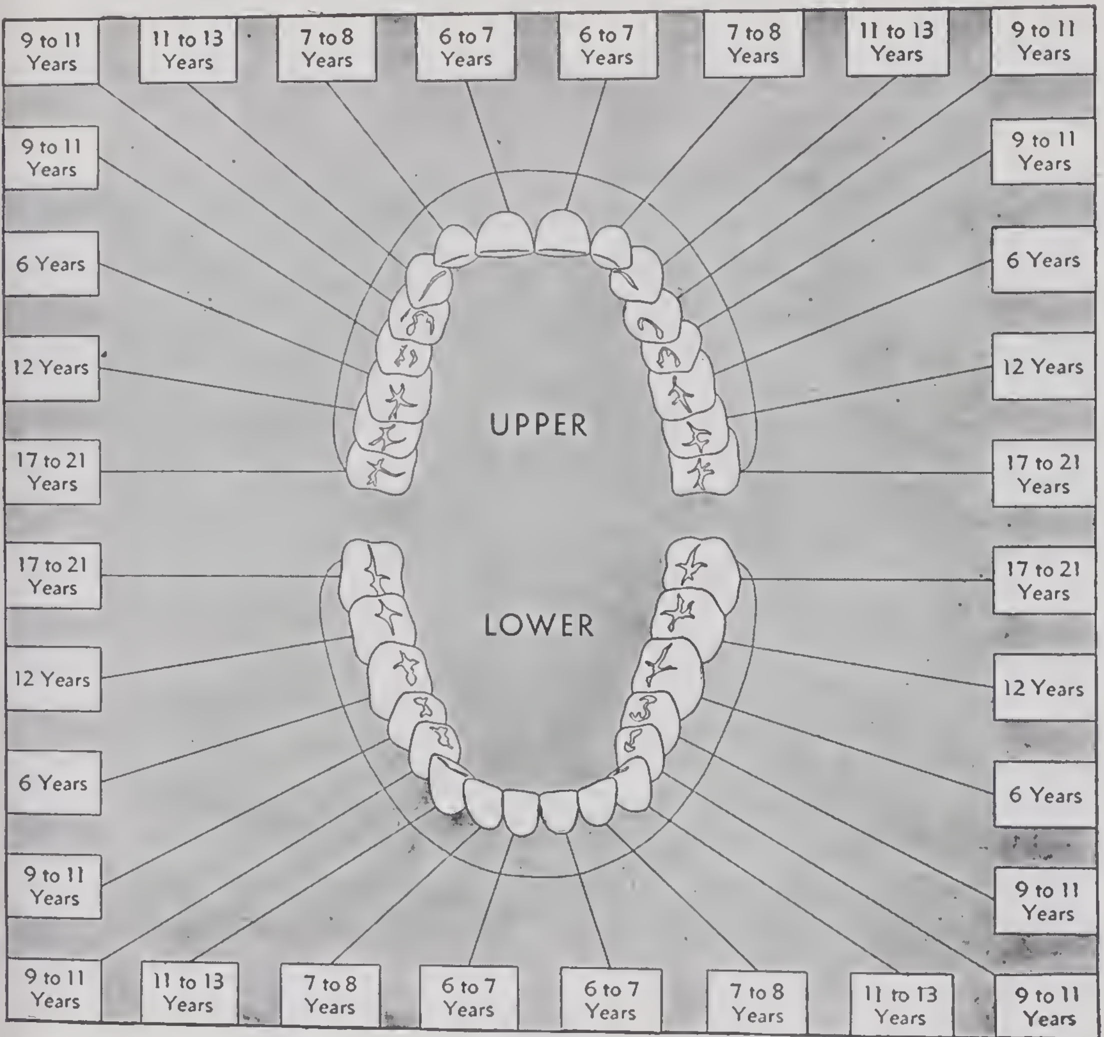

Fig. 77.—The permanent teeth. (Courtesy of the California Fruit Growers Exchange.)

Boyd's survey of American food habits shows that the average milk consumption is suboptimum. Vitamin D is similarly deficient, especially during winter months and in the northern part of the country. The total protein intake of children is low, due in part to this low milk intake. The consumption of vegetables and fruits is not adequate. These deficiencies are compensated calorically by increased intake in cereals, starches, and sugars. Boyd says:

"The diets in common use consist of foods low in protective value to such a degree that one would predict malnutrition from the nature of the foods consumed, even if its tangible evidence were lacking."

Dr. Genevieve Stearns has offered an interesting possibility which deserves consideration when dental caries persist in spite of an apparent adequate dietary intake. In discussing mineral nutrition, she reports several cases. Briefly, one case: A 14-year-old girl came to the clinic "because of sudden and devastating dental caries—some 26 cavities appeared within a few months."

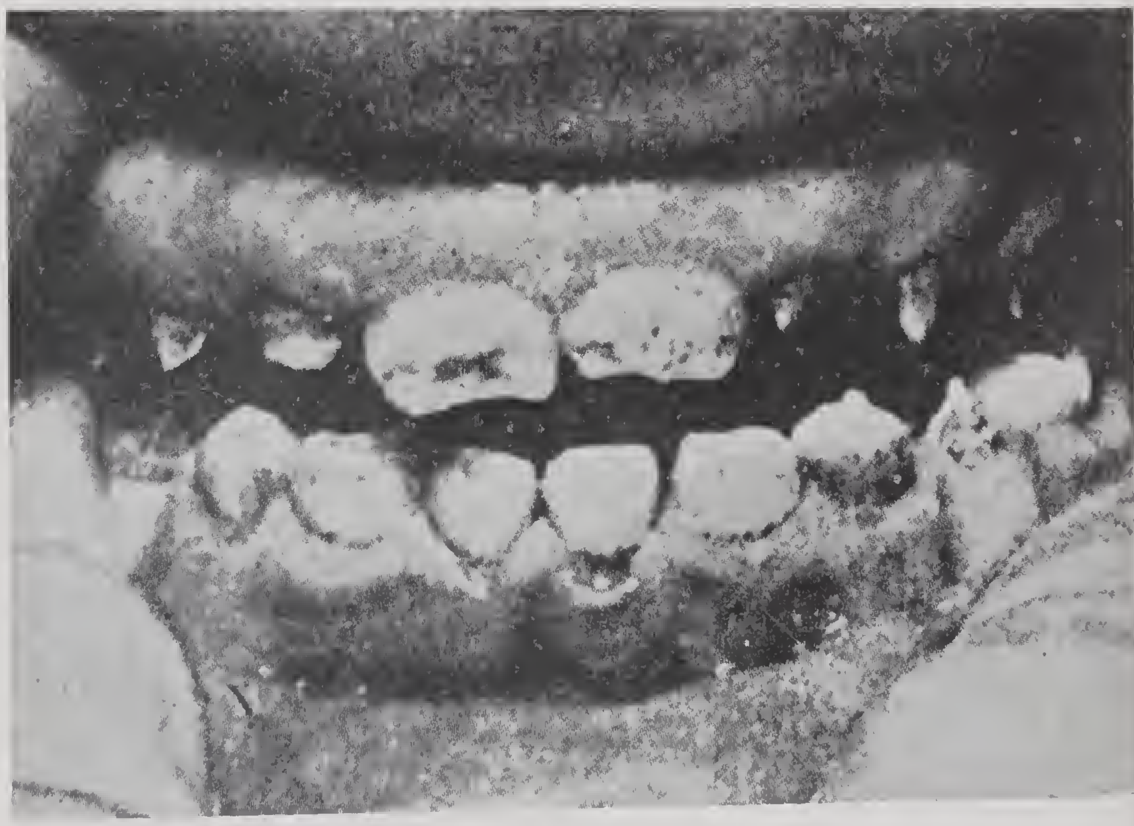

Fig. 78.—Vitamin D deficiency affects the teeth. The lack of calcium, phosphorus, and vitamin D affects the teeth. This 11-year-old child had severe rickets when 8 months old, caused by two little vitamin D. (Courtesy of the Wisconsin Alumni Research Foundation.)

Clinical examination gave no clue. Metabolic study indicated that calcium and phosphorus were not retained in spite of an adequate diet. The vitamin D intake was also satisfactory. The girl's vitamin A status was measured and found to be subnormal. Evidently, vitamin A absorption was below par; if so, vitamin D absorption should likewise be below par. Bile salt therapy was instituted in order to facilitate fat absorption. Within a few days, calcium and phosphorus retention returned to normal, the

vitamin A status was improved, and the caries were arrested. Failure to utilize dietary vitamins A and D may well be subjected to further investigation.

On the other side of the question is the school which would explain dental caries on the basis of a chemicoparasitic theory, namely, that there is localized destruction of first the enamel and then the dentine, due to acid products of fermentation of carbohydrate foods resulting from microorganism activity, chiefly *Lactobacillus acidophilus.* Bunting, one of the early supporters of this latter theory, believes that continuous action of this sort will eventually affect even the strongest teeth. Decrease in carbohydrate intake, especially "sweets," coupled with proper brushing and the filling of pre-carious pits which can readily become "little lactic acid factories," have been shown by experimenters belonging to this school to result in a decrease in the incidence of caries.

Blayney, director of the Zoller Dental Clinic of the University of Chicago, feels that corrective measures have failed; the dental profession is totally unable to halt tooth decay by the placement of fillings. Preventive steps are imperative if progress is to be made. He, too, is convinced that "the mineral salts of the teeth are removed and decay is started by the presence of an acid on the tooth surface," thus giving support to the chemicoparasitic theory. He believes that it is not necessary for the food particles themselves actually to remain on the teeth; passage of fermentable material through the mouth is sufficient. The American people, especially the American youth, consume much more sugar than dietary standards suggest. A report published in 1946 by the Department of Agriculture (Bureau of Agricultural Economics) estimated that 713,000 tons of sugar were used in bottled beverages within that year and that candy utilized 491,000 additional tons. Dental caries is primarily a disease of childhood and youth. Far too many sweets and sweet drinks are consumed between meals, thus permitting optimum conditions for acid formation. Soft drinks are approximately 10 per cent sugar solutions. Decay is not a continuous process but is activated repeatedly by the taking of fermentable foods.

Candy and the soft drinks could so well be controlled in the diet of children; they all too frequently reduce the desire for the more important foods and natural sugars. Concerted effort in this direction is important.

The role of fluorine in tooth development is of current interest. Mottled enamel is characteristic of individuals living in districts where the fluorine content of the water is high. The teeth appear dead white and unglazed, and are pitted, corroded, and structurally weak. However, curiously enough, field studies have shown that there is a lower incidence of caries in the areas of mottled enamel. Rats have been shown to develop less caries on a caries-producing diet when fluorine is added to the diet. Fluorine seems to reduce both the acid production of the oral bacteria and the solubility of the dental tissues. Progress in fluorine research, and indications as to optimum amounts, should prove of great dental value. When water contains 1 part per million of fluorine, the "critical" point is reached between mottled enamel and reduction of caries. More than this concentration produces mottling and appears to have no greater protective value against decay. Accordingly, this (1 part per million) is the accepted optimum level of concentration. Already the practice of deliberately adding fluorine to the drinking water supply has been begun by municipalities in order to obtain this protective level. Data suggest that for children in the early years of life (first eight) when tooth formation is taking place the drinking of fluorine-containing water has definite effect in holding the incidence of caries to a level lower than that of children drinking water containing less or no fluorine. Data are not yet sufficiently large to assay its value for adults where tooth development is complete.

Objection has been raised to this practice on the basis of the toxicity of fluorine. Fluorine is highly toxic in large amounts. (Rodent poison is a potent source of fluorine.) A single massive dose—roughly 10 gm.—may be fatal within hours. However, in the extreme dilution of 1 part per million not the slightest toxic effect could be had regardless of the amount of water drunk. A toxic dose of roughly 10 gm. would require the ingestion of 2,500 gallons of water fluorinated to the extent of 1 part per million (1 gm. in 250 gal.) within a few minutes of time.

Its use by the practicing dentist is fast becoming popular. Two strengths of solution are used. The stronger one (a 2% solution) is applied by the dentist, at stated intervals, directly to the tooth.

The other, a very weak solution, is used in the home as a mouthwash. The reports are encouraging.

Within the year a report appeared from the Mayo Clinic indicating that the continued and *excessive* use of lemon juice as an early morning or between-meal drink (or even serving as an entire meal as in some drastic reduction diets) has an injurious effect upon teeth. The fruit acid, when not taken at mealtime and thus not neutralized by food or removed from the teeth by the meal roughage, may, due to prolonged contact with the teeth, result in dissolution of dental structure. Even though this experiment had not the complete control which one might desire, the results are of speculative interest.

A recent and interesting suggestion comes from Gottlieb at Baylor College of Dentistry. He points out that teeth are unique in that unlike the rest of the body they lack a layer of protective epithelial tissue which is constantly sloughed off and renewed, thereby protecting the underlying tissue from invasion. Teeth instead have a hard sheet of enamel which covers the underlying dentin. Why this hard protective coat should be vulnerable to bacterial invasion has been a puzzling question. The attack by acid seemed a solution, and the production of the acid by bacterial action on carbohydrates logical; but in assuming that bacteria are the cause they are "mistaking an effect for a cause." In the opinion of Gottlieb, the explanation lies in the fact that organic threads (lamellae) of noncalcified material run through the enamel. These represent 5 per cent of the enamel. This fact has been known since 1878 but its significance not appreciated. The longer of these threads extend from the outer surface to the inner dentin, which is only 33 per cent calcified. It is through these lamellae that bacteria, "under favorable conditions for them," reach the dentin where decay can proceed. This accounts for the extent of decay which sometimes is present in spite of an apparently intact enamel. Perhaps in time the cause of the bacterial invasion will be found, but in the meantime Gottlieb proposes to "close the lamellae against invasion." He accomplishes this by precipitating an insoluble salt within them. A chemical compound (a zinc chloride-potassium ferrocyanide salt) placed upon the teeth at appropriate intervals impregnates the

lamellae and produces block. With these treatments Gottlieb has reduced the dental caries in 90 per cent of his cases.

He challenges the theory that fluorine acts through inhibition of acid; he suggests instead that it acts rather by attracting calcium to itself in the lamellae, thereby forming an insoluble salt block.

If one considers the evidence, it seems sensible to take a mid-course, to fight dental caries with personal and professional care of the teeth, and the ingestion of a diet containing adequate calcium, phosphorus, vitamins A, B group, D, and C, and *carbohydrate in moderation*. To assure these substances, the diet should include the daily quart of milk, one egg, a glass of citrus fruit juice, or some other potent source of vitamin C, at least one other fruit or raw green leafy vegetable, a generous serving of butter, and a fish oil of some kind, unless the diet is fortified or unless irradiated milk containing 400 U.S.P. units of vitamin D is used. Candy should be curtailed, and simple desserts or fruit should replace the sweet and rich dishes. The curtailment of carbohydrate will, naturally, result in a compensatory increase in fat if the calorie level is kept constant. This type of diet has been reported to be beneficial in promoting tooth health. In fact it is the diet which should promote optimum nutrition. In other words, adequate structural material during the period of tooth formation with protection of the teeth by curtailment of sweets—especially sticky sweets—and the careful removal of film with its possibilities for bacterial action after eating should be the basis of tooth care.

Furthermore, it must be recognized that tooth decay is not only a localized process but it may produce highly undesirable effects in other parts of the body. This is a matter of no small significance. Any progress which is made toward tooth health is progress toward improved general health. To quote Dr. Blayney: "While non-dramatic in character, it is a public health problem of first importance."

Review Questions

What theories have been developed concerning dental cavities?

Is it logical to think that nutrition affects teeth less than other parts of the body?

Why is prenatal nutrition important in relation to strong teeth?

What nutritents in particular have been shown to be essential for normal tooth structure?

What general rules should be followed as a preventive measure?

CHAPTER XXVI

THE DIET OF OLD AGE

A quotation from the Borden Review of Nutrition Research titled "Nutrition in Geriatrics" indicates why geriatrics has become an increasingly important phase of medicine. The discussion begins with a quotation from *Geriatric Medicine* by Stieglitz.*

"Aging is a part of living. All living matter ages and as it ages, changes. Aging involves every one of the innumerable aspects of life. It begins with conception and ends only with death. Thus, growth, development and maturation are just as much consequences of the occult process of aging as are the atrophies and degenerations of senility. Evolution and involution are both affected by aging; pediatrics and geriatrics are closer than many realize. Gerontology is the science of aging in the broadest sense. The aged and aging are not the same; the aged are people, aging is a process. Whereas pediatrics is concerned with the early stages of the life span, geriatrics is that branch of medical science concerned with the physiologic and pathologic problems of older individuals. Geriatrics is thus but a part, a sub-division of the broader field of gerontology."

The quotation continues:

"Geriatrics is a relatively recent branch of medical science. The greatly increased expectancy of life and the large predominence of elderly people in our present population have stimulated an interest in the problems of the aged which has hitherto been almost completely lacking. At the time of the Roman Empire life expectancy at birth was approximately 23 years. During the next 19 centuries the average rose very slowly, reaching an expectancy of 40 years by 1850 and 47 years by 1900. Following the turn of the century, the rise has been dramatic, life expectancy increasing to about 63 years by 1940. The increase in the brief period from 1900 to 1940, thus, almost equalled that for the preceding nineteen centuries. In 1900, 17 per cent of the population of the United States was 45 years or older; by 1940 the number of persons over 45 rose to 26.5 per cent. The number

*W. B. Saunders Co., 1943.

of persons now over 65 in this country (approximately nine million) has increased at a rate almost five times the increase in general population rate."

As Stieglitz points out, the present situation is without precedent. In earlier centuries, wars, famine, and pestilence have caused severe shifts in population structure but always in the direction of relative increase of youth. Improvements of modern civilization and advances in medical science, however, have tended to extend the life of the less hardy, so that along with the increase in longevity is the problem of maintaining the health and usefulness of the new millions of the aged.

In the first quarter century of life the growth stimulus is great and structural changes are many. In the second and third quarters growth and weight are essentially stationary. The extent to which health and vigor are retained in the third quarter is dependent, to some extent at least, upon the diet that has preceded it. If the diet has been adequate until this time, and disease has not taken its toll, the adult reaches the half century mark with a feeling of being still young, in fact, in the prime of life. From then on, however, he will be more content to watch the game than to play actively. His activities are gradually and unconsciously curtailed, his movements are slower and more deliberate, and he seeks a life of ease and comfort. Appetite is probably still keen and food is thoroughly enjoyed, but there is need for a decrease of intake to compensate for the change in activity. And as age increases there is a gradual checking of life's fire as glandular activity slowly decreases. This is added reason for decreased food intake. On the basis of weight, in fact, the caloric requirement is approximately one-half that of a two-year-old child. According to the older ideas of body protein being static, it was assumed that the protein requirement was definitely less since growth was no longer a factor. If, however, the theory of a constant breakdown and resynthesis of body protein is accepted, then the protein level should remain around 1 gm. per kilogram—certainly not less than 0.75 gm. per kilogram.

The diet of old age, or geriatrics as it is now called, is not unlike the diet of small children. Both are, in most respects, the diet used in convalescence. For details the reader is referred to Chapters XXIV and XXVII. The difference between these diets

and that of old age is only in the energy and protein content unless specific functional change has occurred. An easily digested, relatively smooth, bland diet, containing 0.75 to 1 gm. of protein per kilogram of body weight and supplying 1,500 to 2,500 calories, is usually adequate.

The diet in geriatrics has become of sufficient importance to have a committee appointed by the Food and Nutrition Board of the National Research Council to study the aging process. It is recognized that the period of productive activity can be extended by dietary adequacy. Since the number of individuals over the age of 60 is increasing, the state of their health assumes economic importance. The 1940 census indicates that there are 9 million people over 65 years of age in the United States. This is an increase of 36.5 per cent in 10 years, in contrast to only a 7.2 per cent gain in total population.

Dr. C. Ward Compton contends that man has seven ages: chronological (age in years), anatomical (stage of growth and change in cells, tissue, and organs), physiological (how effectively and normally the organs function), psychological (mental alertness and attitude), and lastly the pathological age which refers to the changes brought about by disease.

One should be able, to at least some extent, to control his aging through medical care, proper diet, correct health habits, and a philosophical and tolerant outlook on life.

To change the eating habits of those of advanced years is not easy. But they, too, must learn the value of good nutrition. Food is as important in old age as at any other time of life. The idea that for elderly people food is of little concern is no longer acceptable. The theory was based on the idea that energy expenditure is the only dietary concern when the "prime of life" is past. This is, of course, fallacious. Vitamins, minerals, and protein are still essential, perhaps even more so.

The decrease in metabolic rate corresponds roughly to a 10 per cent decrease between 60 and 70 years, a 20 per cent between 70 and 80, and a 30 per cent fall over 80.

The salivary glands may be sluggish, the gastric juice have a decreased HCl, and the other digestive juices may be decreased in amount. Hence, seemingly harmless foods may sometimes produce "indigestion." Frequently there are physical changes

in the gastrointestinal tract—lack of teeth, improperly fitting dentures, decreased motility, atrophy, etc. Absorptive ability is usually decreased. Kidney function may be impaired. Diarrhea and constipation are common complaints. Anemia is a common finding. These are factors which influence dietary planning.

Fat may be less well tolerated and may need sharp restriction. (Carbohydrate is then increased as compensation.) Perhaps decrease in cholesterol-containing foods is wise by reason of the normal vascular changes which take place in aging. And excessive salt is probably unwise.

The logical diet, then, is one of adequate protein, decreased fat, and enough carbohydrate to yield sufficient calories to meet the specific need. The meals should be simple relatively smooth, and should be devoid of highly seasoned and gas-forming foods. Six small meals are preferable to three hearty ones. In addition adequate rest, relaxation, occupation, and "fun" must be considered as part of his health program.

As Piersol and Bortz suggest, "Add life to years rather than years to life." To combat the ills which normally accompany advancing age, good nutrition is important. The age of tea and toast is past.

Review Questions

Are the food nutrients found to be necessary for the young less important for elderly people?

How does the energy value of the diet in old age compare with that of the young?

What precautions should be taken in the type of foods served to older people?

How and why have our ideas changed in the care and treatment of elderly people?

What is the name given to the branch of medicine which deals with this group?

PART III

DIET THERAPY

CHAPTER XXVII

GENERAL SUGGESTIONS FOR DIET THERAPY AND THE FEEDING OF INVALIDS

The term *diet therapy* implies treatment by diet which will improve the clinical condition of the individual and will not be detrimental to his general health. Treatment of any clinical condition must take cognizance of the fact that the patient's specific ailment is of no greater importance than the patient himself as an entity. All too often in the zeal to relieve a specific dysfunction, dietary restriction is such that deficiencies occur. The first consideration in diet therapy, therefore, is to keep the patient in a state of good nutrition or to bring him to this state, since in any pathologic condition good nutrition is a help and malnutrition is a hindrance.

A diet that is to be continued for only a short time need not necessarily be nutritionally adequate. It may safely be limited or adjusted as desired. However, *a diet that is to be continued over a period longer than one or two weeks must be adequate to meet the nutritional needs of the patient,* if his condition permits its ingestion at all, in spite of the physical texture of the diet or the patient's capacity for food.

Occasionally a patient is too ill to eat. When this occurs, feeding measures must be employed. He may be fed intravenously by blood **transfusions.** Under certain conditions, especially if there has been blood loss, this is ideal, at least as a beginning, since it immediately provides all the essential nutrients, formed elements, and antibodies of the blood. Transfusions are used frequently today and are of great value. No longer are they considered as a last resort.

Another method of feeding is by slowly injecting fluids subcutaneously or intramuscularly (**clysis** or hypodermoclysis). This is useful in supplying large amounts of liquid to patients who might otherwise become seriously dehydrated. Physiologic salt solution (0.7 per cent, approximately 1 teaspoonful to a pint of water) or glucose (2 to 5 per cent) may be given in large amounts.

Glucose in various concentrations or physiologic salt solution can also be given directly into the vein (**intravenously**). By a slow continuous drip method it is possible to administer large quantities of fluid salt and glucose. As high as 5 to 6 liters may be given in twenty-four hours. Since the percentage of glucose may be high, several thousand carbohydrate calories may be supplied, and may be lifesaving in starvation from acute illness. Fluids should not be forced beyond 8 to 10 per cent of body weight in twenty-four hours. Above this amount water intoxication will result with chills, nausea, vomiting, sweating, dizziness, and even disorientation and convulsions.

When glucose is administered, members of the B complex incorporated in the solution facilitate its utilization and is considered the logical procedure. The addition of ascorbic acid may be worth while.

Protein can satisfactorily be administered either as a mixture of pure amino acids or as a protein digest. A 5 per cent amino acid, 5 per cent glucose solution is well tolerated. Fats* also have been successfully administered by intravenous injection with the protein and glucose. (See discussion of Parenteral feeding.)

Especially in surgery, the use of a high protein, high vitamin C level is of distinct value in promoting wound healing.

Gastric gavage is another method of feeding. By this method food in liquid form is introduced directly into the stomach through a tube from the mouth, nose, or an artificial opening in the gastrointestinal tract. The liquid foods discussed below are suitable for this method of feeding. It is a valuable method in feeding patients who are unable or unwilling to swallow.

A less effective method, but one which may be resorted to, is the **nutrient enema**. A 5 to 10 per cent glucose is ordinarily used, but little dependence can be placed upon the absorption of the sugar. Water, however, is absorbed.

The crystalline vitamins may be given intravenously or intramuscularly, alone or in any solution, when deficiencies require immediate correction.

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*Clark and Brunschwig report the daily use of a highly emulsified fat over a 17-day period (Proc. Soc. Exper. Biol. & Med. 49: 329, 1942). Five hundred c.c. finest grade olive oil were emulsified with 250 gm. commercial egg lecithin and added to 1500 c.c. triple distilled water. Mixture was passed through homogenizer, then autoclaved. One thousand c.c. of 10 per cent dextrose, 500 c.c. of 10 per cent casein digest (amigen), and 500 c.c. fat emulsion were combined and administered intravenously night and morning at the rate of 500 c.c. per hour.

More recently other investigators have been experimenting with fat injections and finding it may prove a feasible addition to intravenous feedings where high caloric intake is indicated. (Nutr. Rev. 6: 231, 1948.)

Except when cancer or throat or mouth injuries necessitate prolonged feeding, the above-mentioned types of feeding rarely are continued for long periods. Much more acceptable are the types of feeding discussed below, the liquid, semisolid (semiliquid or soft diet), and the diet used during convalescence.

The **liquid diet,** as the name implies, is of a consistency to pass with ease through a drinking tube. The diet may be palatable and adequate. There is no need for monotony if ingenuity and care are exercised in its preparation. Rules established for normal diets may be applied to liquid diets.

Milk is the major source of the protein of high biological value. Milk with slight padding could be made biologically adequate if it were not that the bulk necessary to meet caloric requirement would be too great. However, using milk as the foundation, it is possible to build up varied diets. For example, 1 quart of milk plus 50 c.c. of 40 per cent cream and 50 gm. of lactose, forms the "milk-cream-lactose drink" of Coleman which yields 1,000 calories. In general, the term "milk" includes whole milk, skim milk, buttermilk, whey, malted milk, and any of the proprietary milk drinks used for feeding of infants.

Powdered milk, either whole or skimmed, makes a valuable and inexpensive padding for milk. Roughly 1 cup of the powdered milk added to a quart of the liquid milk results in a milk of double nutritive value. Or 2 cups of the powdered milk may be added. The resulting triple rich milk may also be used as such or be made into a variety of palatable drinks.

A new and valuable meat product has come onto the market within the last two years, puréed meat—lamb, beef, pork, veal, liver, and heart. These may be diluted with broth, Vegex, vegetable juice, or milk to the desired consistency. These serve as excellent protein padding.

Water or milk thickened with cereal becomes a gruel. Any cereal may be used, farina, oatmeal, rice, barley, corn, arrowroot, etc. Instead of using the usual ratio of cereal to liquid, as in the preparation of breakfast food, from one-fourth to one-third as much cereal to liquid is used, depending upon the consistency desired. The usual amount of salt should be added and the gruel should be cooked for an hour in a double boiler top to assure digestibility. The gruel may be made with whole milk, skim milk,

water, whey (the lactalbumin in whey is digested with greater ease; see Milk), or with diluted or undiluted evaporated milk, depending on the food value desired. Or the gruel may be merely breakfast cereal diluted to the correct consistency with any chosen liquid. Smoothness, temperature, consistency, and seasoning are of paramount importance. The difference between cold, lumpy, unseasoned gruel, and hot, smooth, well-seasoned gruel is striking. Straining is essential for smoothness. Gruel may also be made by soaking any of the "cold" cereals or crackers in the proper amount of hot liquid. Gruels may be enriched with cream or butter, egg yolk or whole egg, or grated cheese. Combinations of cereals lend variety.

Cream soups are gruels to which vegetables have been added. They may be prepared by using a flour or cornstarch gruel as a base in order to avoid distinctive cereal flavor. Such gruels are known as white or cream sauce. Any cooked vegetable which has been rubbed through a strainer may be added. Vegetables served to the family may be added to a white sauce to form a cream soup for an invalid's tray. Strained vegetables prepared for infant feeding may be used in this way. The caloric and nutritive values of cream soups may be adjusted by the type of milk used, or by padding with cream or butter. Mixtures of vegetables form delicious flavor combinations. Clear vegetable juice, especially with a few drops of lemon, is usually well liked. Powdered debittered yeast may be added if desired, thus increasing the nutritive value.

Fruit may be given as fruit juice and is refreshing enough to be well tolerated by most individuals. It may be padded with lactose, egg, or banana rubbed through a fine strainer and beaten into the juice. Lactose in large amounts has a temporary laxative action, but one tablespoon to a glass of fruit juice is well tolerated. Beta lactose is five times more soluble than the alpha form. Gelatin may be dissolved in any fruit juice and thereby increase its protein value. Such a drink must be served immediately to prevent thickening of the juice before ingestion.

The protein level of milk may be increased by adding powdered skim or whole milk, protein milk, Casec (calcium caseinate), gelatin, or egg, or any of the new high protein products may be used. (See Table 125.)

Milk drinks may be flavored in countless ways with chocolate, cocoa, vanilla, coffee, spices, molasses, etc. Dark cane molasses supplies approximately 1 mg. of iron per tablespoonful and is a

source of vitamins B_2 and B_6, and pantothenic acid. Preparations such as Cal-C-Tose (Hoffmann-LaRoche), Dietene (The Dietene Company), Vitikon (Upjohn), and other similar preparations add variety, vitamins, and extra protein and minerals to milk drinks. Powdered yeast makes a valuable addition to any drink and if carefully prepared may not be unpalatable.

Broths and clear soups add fluid and salt content to the diet. They have negligible calorie content. If Vegex, a yeast preparation, is added, or is used with any liquid, the drink will have a good store of the vitamin B complex. Vegex contains approximately 22 vitamin B_1 and 25 vitamin B_2 units per gram, and a teaspoonful weighs 6 gm. It is a delicious preparation with a meat flavor and may be served as a broth.

Carbonated drinks are refreshing and when cream or ice cream is whipped in, they have definite food value. Tea and coffee may be allowed in moderation, except in rare instances.

Thus, any caloric, fat, protein, carbohydrate, ketogenic-antiketogenic level or acid-base balance may be obtained in palatable, attractive liquid diet which may be maintained indefinitely. In making adjustments as to protein, fat, and carbohydrate levels, or in padding, it must be remembered that diarrhea may result from high lactose or large amounts of fat, and that fermentation with gas and possible distention may result from excessive use of any sugar.

The **semisolid** diet (semiliquid or soft) is self-descriptive. It should contain only such foods as may be swallowed without chewing, and which contain no roughage. It should not be considered as offering a wider choice of foods than the liquid diet, but merely as a different method of serving them.

Milk, in the many ways already suggested, continues to be a primary essential.

The puréed meats carefully seasoned and heated may be served as such or be made into cream soups.

The cereal is no longer used as a gruel, but as a thicker mush. If a whole grain cereal is used, it should be strained before serving. Sugar, cream, milk, or butter may be added. Or the cereal may be sweetened in preparation and served as a pudding, such as rice or tapioca, with a sauce, with cream, or plain. Egg white may be whipped into the pudding to give added lightness and protein value. By using a bland cereal (cornstarch) for thickening milk or cream, and adding flavoring, a great variety of corn-

starch puddings may be made. Egg may be added or the pudding may be served with custard sauce or a thickened fruit juice sauce.

Fruits may be prepared in various ways, as fruit whips or soufflés, and eaten raw, stewed, or baked. Powdered milk may be folded into these as a means of increasing protein level. Bavarian creams and other soft gelatin desserts add variety. Fruit ices and ice cream are also suitable.

To create variety in the serving, vegetables may be rubbed through a sieve, or served as purées, or folded into egg white and baked as soufflés.

Hence, with the exception of meat, the same foods served in normal diets may be served in either liquid or semisolid diets.

During **convalescence** the diet continues to be important. Care must be taken that only those foods which can be readily digested and which contain limited roughage and seasoning are included. The amount of roughage allowed will depend somewhat on the nature of the illness. The strainer will be used to varying extent. Foods in a form which requires moderate chewing may be allowed at this time: tender meat, eggs in any form except fried, and desserts of all kinds except those excessively sweet, rich pastries, or fried batters.

A "full" tray would be planned following the restrictions for the diet in convalescence. This type of diet is the same as that for small children and the aged, and for patients with gastrointestinal disturbances.

At all times attractiveness and palatability are of importance. Appetite must often be tempted by small amounts of food served with utmost care. Colored trays, colored dishes, flowers, unusual linen will many times influence a patient to try to eat. Then the taste-teasing quality of the food itself may tempt him to continue. Too much stress cannot be put on attractiveness of food and service. Nutrition must become an art as well as a science. At times food becomes the lifesaver. With its ally, good nursing care, it is frequently more effective than medication.

High Protein Diets

Since the second edition of this book appeared, there has been new emphasis on protein metabolism and need—a tendency toward higher protein in the therapeutic diet. Research and practical experience have shown that higher protein diets are of

value in many clinical conditions: surgery, both preoperative and postoperative, burns, trauma, infections, convalescence, hemorrhage, ulcers, ulcerative colitis, edema, nephroses, pregnancy and lactation, allergy and subnutritional states. It is essential for any growth or recovery. Toxic destruction of protein in cases of acute infection may actually mount to five or six times normal.

Protein metabolism cannot be halted. On a diet completely devoid of protein, nitrogen continues to appear in the urine, indicating utilization of body protein. On experimental diets containing no protein, the protein equivalent of the urinary nitrogen ($N \times 6.25$, since protein is approximately 16 per cent nitrogen) indicates that the protein breakdown amounts to 3 or 4 per cent of the total caloric production. In the adult man this is not far from 25 gm. protein daily. It is evident, then, that protein deficiency can increase rapidly in the face of increased need and inadequate supply.

Stare and Thorn* list the causes of protein deficiency (Table 74).

TABLE 74

1. Insufficient intake, quantitatively or qualitatively
2. Impaired digestion or absorption—chronic diarrhea, fistula, etc.
3. Inadequate synthesis of protein—liver disease
4. Increased breakdown of body protein stores—febrile states, high metabolic rate, etc.
5. Excessive loss of protein such as that in nephroses, ascites, or hemorrhage

The need of high protein in the treatment of severe burn is typical. The hypoproteinemia in these patients is due to toxic destruction, loss of serum protein in exudates, by failure of the liver to normally synthesize protein, by decreased intake due to loss of appetite and shock and frequently to vomiting and diarrhea. It has been indicated that when 5 to 10 per cent of the body is burned, 125 gm. protein are required daily; when 10 to 20 per cent of the body is involved, the need rises to 200 gm.; and when over 20 per cent is involved, 300 gm. daily is required—high protein with a high caloric intake of 3,000 to 5,000 calories.

The protein used when high intake is indicated should be largely of animal origin to insure adequacy of the essential amino

*J. A. M. A. 127: 1126, 1945.

acids. Cannon in his studies on protein utilization has proved that:

"There is evidence that tissue synthesis will not occur unless every component required is available or can be manufactured by the cells. There is presumably an over-all proportionality relationship in regard to the individual amino acids utilized and tissue synthesis comes to a standstill when a single essential amino acid is absent. Therefore if one essential amino acids is absent all the others become largely useless for the purposes of tissue synthesis."

As one plans and calculates the normal diet it can be seen that from 70 to 100 gm. of protein can be readily supplied. Above 100 gm., intake padding must be resorted to. Such padding can be both at mealtime and as the between-meal drinks. (See previous discussion under liquid diets and the list of protein values in the appendix, Table 125.)

Turner,* in her summary of the "protein containing foods to meet protein requirements," outlines three levels of protein-low or 50 gm., medium or 70 gm., and generous or 100 gm.

TABLE 75

SAMPLE PLAN CONTAINING 50 GM. OF PROTEIN

	PROTEIN (GM.)
1 pint of milk or milk equivalent	15
1 egg	6
2 ounces meat or poultry or fish	12
3 vegetables	3
2 fruits	2
4 slices of bread or equivalent grain product	12
Total	50

A number of high protein products, in addition to those previously mentioned, suitable for oral use have come onto the market: Gerilac, Meritene and Dietene Accessory Feeding, etc. Excellent suggestions for use accompany some products. Countless other protein products are available which serve admirably for tube feeding, but flavor in many instances makes their normal oral administration difficult. We have Aminoids Nutragest, Protolysate, Essenamine, Somagen, Lactamin, Delcos Granules, P.H.V., Protinal, and many others. These are digests of various proteins, either one or of a combination (liver, yeast, casein, lactalbumin,

*J. A. M. A. 128: 590, 1945.

TABLE 76

BASIC PATTERN OF DAILY FOOD INTAKE FOR AN ADULT MAN (70 KG.)

DAILY FOOD INTAKE	APPROXIMATION OF PROTEIN CONTENT* (GM.)
16 oz. (1 pint) of fluid milk or 8 oz. of evaporated milk or 1½ oz. (5 tablespoons) of dried skim milk (1 serving [4 oz.] of milk pudding or ice cream may be approximately equivalent to 3 oz. of fluid milk)	15
3 oz. serving of meat or poultry or fish (cooked, edible portion) or 1½ oz. of soybean flour or 5 oz. (¾ cup) of cooked soybeans	18
1 oz. of American cheddar type cheese or 1 oz. of cottage cheese or 1 egg	6
3 oz. serving (one-half cup) of cooked peas, navy beans, or lima beans, or ¼ cup cooked soybeans, or ⅔ oz. (1½ level tablespoons) of peanut butter	6
3 oz. serving (½ cup) of potatoes	2
Other vegetable—3 servings, of which 1 is green leafy or yellow	3
Fruits—2 servings, of which 1 is citrus or tomato	2
Six slices of bread, enriched or whole grain, or equivalent grain product (The approximate protein equivalent of one slice of bread is a 1 oz. (dry weight) serving of cereal or ½ cup of cooked spaghetti or noodles or 6 soda crackers or 1 small piece of cake or a 2 inch cube of cornbread or 3 graham crackers)	18
Total	70

*Meat, poultry, fish, cheese and nuts range between 10 and 30 per cent protein. Grain products (dry weight), fresh peas and beans contain between 7 and 15 per cent protein. Eggs contain approximately 12 per cent protein. Milk is about 3 per cent protein. For more detailed figures on the percentage composition of foods, see Table 125.

TABLE 77

DIET CONTAINING 100 GM. OF PROTEIN

DAILY FOOD INTAKE	PROTEIN (GM.)
40 oz. fluid milk	36
2 eggs	12
3 oz. serving of meat, poultry or fish	18
1 oz. American cheddar cheese, or 7 oz. milk	6
3 oz. serving of legumes or 1½ tablespoons peanut butter	6
1 serving of potatoes	2
3 servings of vegetables	3
2 servings of citrus fruit or tomato	2
5 slices bread, whole grain or enriched	15
Total	100

wheat). They may be hydrolyzed (such products are known as hydrolysates) either by acid or enzymes. They may or may not have carbohydrate, minerals, and vitamins added. Careful reading of the label is essential. They range in protein content from 15 to 75 per cent—and in price up to $5.00 per pound. Comparison of the label data with the composition of powdered skim milk at 25 to 30 cents a pound gives added emphasis to the value of powdered skim milk for oral use.

Co Tui* in discussing some clinical aspects of protein nutrition lists the requirements for the oral form (Table 78).

Table 78

1. Taste. Protein hydrolysates have a peculiar taste—liked by a few, tolerable to others, and objectionable to still others. Indeed, it may be said that it is the taste which is the greatest barrier to a universal use of these products. The palatability varied with various preparations, although it can generally be stated that the more complete hydrolysates are more objectionable than the partial hydrolysates.

2. Solubility and suspensibility. The products must be easily soluble so that they may be given in small bulk. The more complete the hydrolysate the more soluble. If solubility cannot be completely obtained, the product should be easily suspensible, so that hyperalimentation can be achieved without giving too large a bulk.

3. Bacterial count. As far as possible, the product should be bacteria-free. If bacterial contamination is present, it should not number over 200 per gram of the digest. A larger count produces a fetid odor, a nauseating taste, and causes nausea, vomiting, gastrointestinal distress and diarrhea when product is administered.

4. Untoward symptoms. Must not cause distention, distress, diarrhea, vomiting, when given in adequate doses. Generally speaking, preference must be given to products which can comfortably be given in large quantities. The soduim chloride content must be low enough (preferably below 3 per cent) so that a hyperalimentation formula can be given without an overdose of salt. Preferably, too, the other mineral contents should approach those in the normal diet. Because of the use of the oral form of the hydrolysates in the treatment of peptic ulcer, it is desirable to know the neutralizing power of each preparation.

Furthermore, some of these products are suitable for oral use only, others may be used intravenously (parenamine, Amigen).

The use of intravenous feeding (I.V.) has become widespread in recent months, perhaps sometimes needlessly, but many times as a lifesaving measure. This method of feeding is indicated in various conditions. We quote from the discussion on Amigen by Mead Johnson & Company:

1. When the patient cannot take food by mouth:

In this category are patients with gastrointestinal obstruction of any kind, from the mouth to the rectum. Such conditions include esophageal

*J. Am. Dietet. A. 22: 97, 1946.

spasm or stricture, carcinoma of the esophagus, stomach, or colon, pyloric or intestinal obstruction, intussusception, perforation of the intestine, diverticulitis of the colon, etc. To such conditions may be added intractable vomiting, pyloric stenosis, or prolonged anorexia in which even tube feedings are not retained.

2. When the patient should not take food by mouth:

In many patients the ingestion of food is deleterious and the gastrointestinal tract is in need of complete rest. Included in this group are those with severe infection of the gastrointestinal tract as generalized peritonitis; esophagitis; gastritis; gastroenteritis; peptic ulcer; ulcerative colitis; severe diarrhea or dysentery. Included also in this category are all postoperative patients in whom an anastomosis or other surgical procedure is performed on the gastrointestinal tract. Battle casualties with perforated wounds of the abdomen, peritonitis, or those requiring subsequent extensive repair are necessarily included in this group. Patients with high fever, and accompanying anorexia, or with intestinal disease, as typhoid, likewise profit by supportive treatment with Amigen.

3. When the patient is unable to take sufficient food by mouth:

In many cases the physician wants to correct an existing deficiency more rapidly than is possible by the oral route alone. Patients who have suffered from exposure and malnutrition due to inadequate food supply, or those who have been sick from tropical disease and are severely malnourished because of the associated anorexia belong in this category. Others who are extremely malnourished and are unable to eat enough food to correct the deficiency in a reasonable period before operation likewise are benefited by Amigen. In nutritional edema, or in the presence of severe hypoproteinemia, parenteral administration of Amigen is indicated. Patients with severe wounds and burns require large quantities of protein to replace that lost in blood and exudates, by excessive protein catabolism, and to supply the requirement for new tissue. Nitrogen balance must be maintained if healing and tissue regeneration are to proceed rapidly. These patients can rarely meet their protein need by the ingestion of food, but by use of Amigen orally and parenterally the protein deficit may be rapidly corrected and nitrogen balance maintained.

4. When the patient canot properly assimilate protein:

Acute infections, either enteral or parenteral, especially in infants, may diminish the secretion of proteolytic enzymes. It is quite possible that much malnutrition, especially in infancy and in senility, is due not so much to inadequate food intake, as to poor assimilation. In nutritional edema the gastrointestinal tract may become involved, leading to imperfect digestion. Specifically, a need for Amigen has been demonstrated in intractable diarrhea, ulcerative colitis, and pancreatic fibrosis. In such conditions, proteins are often improperly hydrolyzed or poorly absorbed. In cases of delayed healing of fractures, an inability to metabolize protien properly may be in part at fault.

Several factors must be kept in mind in the use of the intravenous method. Regardless of the body's need for protein there is a specific kidney threshold and when the amino acids are injected at a too rapid rate they are excreted in the urine with resulting wastage. In addition, symptoms of discomfort—nausea, vomiting, flushing, difficult breathing—are likely to appear.

One such solution (Amigen, for example) is procurable as a 10 per cent solution. In general, this is diluted with an equal amount of 10 per cent glucose solution:

500 c.c. 10 per cent protein plus 500 c.c. 10 per cent glucose equals 1 liter of solution containing 5 per cent protein and 5 per cent carbohydrate and yields 400 calories

5 per cent each equals 50 gm. each per liter × 4 calories/gm. equals 200 calories × 2 or 400 calories

A maximum of 3 liters a day means the administration of 1,200 calories. Stronger solutions are used but rarely, due to their irritating effect.

Adequate vitamin dosage if simultaneously administered assures maximum utilization of the protein and carbohydrate.

Review Questions

Does diet therapy necessarily mean diet restriction?

In planning any diet which is to be continued over an extended period, what factors must be taken into consideration?

When a person is too ill to take nourishment by mouth, what means of feeding are available?

What is the concentration of physiologic salt solution?

In what form is carbohydrate given? Protein? Fat? Vitamins?

What is gastric gavage? Nutrient enema?

When nourishment can first be taken by mouth, in what form is food given?

May an adequate diet be given in this form? Explain.

Through what stage does the diet next progress?

How does this diet differ from the previous one?

What are the important considerations regarding diet during convalescence?

What type of menu may be served on "full" or "house" tray?

What factors should be stressed in the serving of any diet?

What are protein hydrolysates?

How do they compare in value and cost with powdered skim milk?

CHAPTER XXVIII

DIABETES MELLITUS

The disease diabetes mellitus has been known for centuries. The name is derived from the Greek words *diabetes*—to pour through—and *mellitus*—honey. Aretaeus, the Cappadocian, who lived about the first decade of the Christian era, described two of the cardinal symptoms, emaciation and excessive urination, when he wrote that there was "melting of the flesh which flowed away in the urine." Chinese literature as early as the third century referred to the large volume of urine in diabetes "so sweet that it attracted the dogs," and on through the centuries references to the disease appear, with speculation and suggestion as to its cause and the therapy used. Hot and cold baths, wines, massage in the sun, whey and milk diets were used, as well as various types of medication.

In 1869 Langerhans showed that certain cells in the pancreas had a function other than the production of pancreatic juice. In 1889 Minkowski and von Mehring proved that the pancreas was concerned somewhat with diabetes, since removal of this organ from the dog resulted in diabetes. In 1901 Opie in America and Ssobolew in Russia proved that dysfunction of the cells which Langerhans had described, and which bear his name, resulted in diabetes, and that it was not a dysfunction of the pancreas as a whole.

Between 1869 and 1921 many brilliant experiments were performed which led finally to the discovery of insulin by Banting and Best, who were working in the laboratory of Dr. J. J. R. Macleod in Toronto. They discovered that an extract of the islet cells (or islands of Langerhans) would, when injected into a diabetic animal, control the diabetes. The Nobel Prize in Medicine for 1921 was the reward for this lifesaving contribution.

Since this discovery, and the clinical use of insulin, diabetes has ceased to be the death-dealing disease it was formerly. The diabetic person is no longer an invalid. No longer must he drastically restrict his food, indulge in fast days, or curtail his activities. Insulin has given him a more liberal diet both in kind and

in amount, and he is now able to take his place in the economic world and in the world of pleasure.

Polyuria and weight loss are not the only **symptoms of diabetes.** Extreme thirst (polydipsia), an almost constant feeling of hunger (polyphagia), and a feeling of weakness and lassitude, are among the symptoms pointing to the disease.

Three conditions bear the term diabetes: diabetes mellitus or sugar diabetes; diabetes insipidus, a chronic condition in which enormous quantities of dilute urine are excreted daily (7 to 20 liters and sometimes more) due to pituitary dysfunction; and renal diabetes, a form due to abnormal permeability of the kidney to sugar, resulting in lowering of the renal threshold for glucose and the appearance of sugar in the urine.

As commonly used, however, the term refers to diabetes mellitus, a condition in which the body has lost its ability in varying extent to oxidize sugar because of inadequate insulin production by the pancreas.

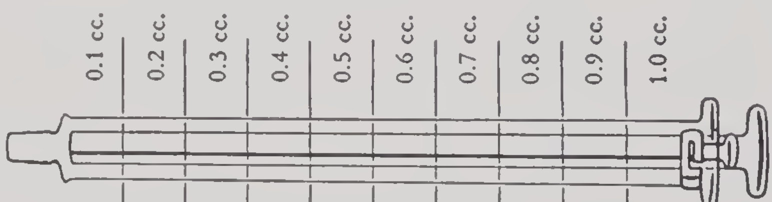
The breakdown of carbohydrates into sugar (glucose), the formation of sugar from protein, and to a limited extent from fat, are normal body processes. In animals rendered diabetic by removal of the pancreas or by phlorhizin poisoning, it is possible to show that when protein is ingested, 58 per cent of it is converted into glucose and that 46 per cent by weight will yield fatty acid. This total of more than 100 per cent is explained by the fact that certain amino acids may yield either glucose or fatty acid. Therefore, the values for the amounts of carbohydrate and fat as ingested are not correct values for the total *glucose or fatty acid available to the body.* To determine these latter values, calculation must be made as follows:

$$\text{Total available G} = 100\% \text{ carbohydrate} + 10\% \text{ fat} + 58\% \text{ protein}$$
$$\text{FA} = 90\% \text{ fat} + 46\% \text{ protein}$$

The expression FA : G always means total available FA and G, not just ingested fat and carbohydrate. For complete oxidation of the glucose and fatty acids to carbon dioxide and water these values have always been considered of importance. Ketosis has been postulated to appear where the FA : G was greater than 1.5 gm. to 1 gm. In fact, 1.5 to 1 ratio has been considered borderline, 2:1 mild ketosis, and 3:1 a definite ketogenic level. On this assumption the ketogenic diet used in epilepsy has been planned

and is used. Foods are said to be ketogenic or antiketogenic, depending upon the potential yield of fatty acid or glucose. Proteins, meats, and eggs yield roughly equal amounts of these substances and are, therefore, essentially neutral. Sugars, starches, cereals, fruits, and vegetables are antiketogenic, and fats and fatty foods are ketogenic.

When high fat diets were in vogue for the treatment of diabetes, the discussion of possible ketosis and its prevention received considerable emphasis. As the balance of sugar to fat swung toward the higher carbohydrate diet, this question ceased to be so important. There was then little danger of the well-controlled diabetic patient going into coma as he might have done on the previous high fat diets. There would be little danger of unburned fatty acids occurring at these newer levels. (See page 69.)



20 units per cc.	2	4	6	8	10	12	14	16	18	20 units
40 units per cc.	4	8	12	16	20	24	28	32	36	40 units
80 units per cc.	8	16	24	32	40	48	56	64	72	80 units
100 units per cc.	10	20	30	40	50	60	70	80	90	100 units

Fig. 79.—Insulin syringe. Etchings indicate units, not cubic centimeters. This enables the patient to measure dosage directly. (Courtesy Eli Lilly and Co.)

Fasting blood normally contains about 100 mg. per cent of glucose (80 to 120 mg.). In diabetes the level is higher, not because the patient produces more sugar than the normal individual, but because he utilizes it less well. If sugar is not oxidized, the level in the blood mounts. A level as high as 1,850 mg. per cent (also expressed as 1.85 gm. per cent, which is grams per cent or per 100 c.c.) has been reported for a patient in diabetic coma. Such values are rare. At a blood level between 150 and 200 mg. per cent (0.15 to 0.2 gm. per cent) sugar appears in the urine, the renal threshold is reached, and the kidneys can no longer hold back the excess sugar and it flows out in the urine. With decreased ability to oxidize sugar, fat utilization is disturbed and diabetic coma or ketosis may develop.

A test meal containing a measured amount of carbohydrate is sometimes used either as a diagnostic procedure or to ascertain the degree of pancreatic dysfunction. A meal containing 100 to 150 gm. carbohydrate is given as the first meal in the day. An initial blood sugar level and one at a 1-hour and 2-hour interval indicates the degree of utilization of the carbohydrate. The normal individual will begin with a level not to exceed 140 mg. per 100 c.c.; at the end of an hour it may be 160, but by the end of two hours it should be nearly back to normal. In impaired carbohydrate utilization the beginning level is higher, the peak higher, and the fall much slower, and sugar will spill into the urine. See normal curve, Fig. 82.

One unit of insulin will bring about the oxidation of 1 to 3 gm. of carbohydrate. A standard unit, determined by bio-assay, is used to express the strength of insulin. Clinically, it may be obtained in several strengths, 10, 20, 40, 80, and 100 units per cubic centimeter of solution. There are several types: the plain or regular extract of hog or beef pancreas; a protamine zinc insulin, a form in which it is more slowly absorbed and exerts its influence over a twenty-four-hour period; crystalline insulin, which is similar to the regular insulin but has the advantage of being protein free; and globin insulin—insulin midway in action between plain and protamine. With one of these, or a combination, it is possible to make up to the patient by insulin injection the difference between the insulin he can produce himself and his requirement, as determined by the total available carbohydrate in his diet. There is no other effective treatment for diabetes except insulin by injection, although many misleading advertisements to the contrary have appeared. If control of diabetes is to be maintained, the diet must be adequate. It must be well balanced between the sugar and fatty-acid forming foods, and it must be adhered to. Insulin does not remove dietary regulations. It merely makes them less stringent. The insulin dosage may need adjustment as the result of certain uncontrollable factors. Duncan lists those requiring insulin increase as: weight gain, increased food intake, decrease in activity, pregnancy, certain therapies (thyroid, pituitary, deep roentgen ray, dinitrophenol, epinephrine), toxemias, acute infections, fever, ketosis, and ultraviolet ray burn.

Today the **diet of the person with diabetes** may be adjusted in several ways. It may consist of high carbohydrate, low protein and low fat; low carbohydrate and high fat; or a middle course with protein at a normal level, fat somewhat raised, and carbohydrate somewhat lowered from the usual values. Even though a physician may prefer a certain ratio between the major nutrients, deviation may become necessary to satisfy food preferences or habits of the patient. Or in some cases of borderline diabetes in the adult a sharper curtailment of the carbohydrate may obviate the need for insulin.

Diets which depart from the normal by a minimum curtailment result in diets less costly, more palatable, and more easily obtained than the diets formerly in general use. In addition, it tends to increase the patient's tolerance for carbohydrate and is less prone to result in arterial changes than a diet high in fat.

Table 79

The following calculations, for example, might be made for an individual 50 inches tall: 50 inches × 40 calories per inch = 2,000 calories—the approximate caloric requirement. Or the requirement might be calculated on the basis of weight, allowing from 100 down to 30 calories per kilogram of theoretical or ideal weight depending upon the age of the patient—100 calories per kilogram for the infant down to 30 for the adult (see Metabolism, Chapter II).

15% calories as protein = 300 protein calories ÷ 4 (cal./gm.) = 75 gm. of protein

45% calories as fat = 900 fat calories ÷ 9 (cal./gm.) = 100 gm. of fat

40% calories as carbohydrate = 800 carbohydrate calories : 4 (cal./gm.) = 200 gm. of carbohydrate

The **diet prescription** would then read: 75 P., 100 F., 200 C.—2,000 calories. This diet prescription, or any other, might be filled by a schematic outline shown in Table 80 and Table 81.

This outline assures adequacy of nutritional essentials and permits sufficient leeway in calories to allow for wide differences in total fat or carbohydrate intake. For simplification, the food allowed is expressed in terms of a representative food of the group. It does not mean, of course, that oatmeal is the only cereal or orange the only fruit. A table of food interchanges appears in the Appendix. The additions may be largely fat or carbohydrate, or any desired proportion between the two by choosing from the foods listed in Table 81, or by increasing the amounts used in the basal diet.

TABLE 80

DIET FOR THE DIABETIC PATIENT

Diabetic Diet for____________________________________ Unit No.____________

Rx:______ Pro.______ Fat______ Carbo.______ Calories______ Date_________

Household Measure	Food for Day	Gram Weight	Protein	Fat	Carbo-hydrate	Approx-imate Calories
3	Oranges	300	3	--	30	130
½ cup cooked	Oatmeal	15	2	1	10	50
1 cup	5% vegetable	200	2	--	10	50
1 cup	10% vegetable	200	2	--	20	90
2 servings	Meat or fish					
	(1 average—3 oz.)	90	24	14	--	200
	(1 small—1½ oz.)	45	12	7	--	100
1	Egg	50	6	6	--	75
1 pint	Milk (whole) *or* 16 tablespoons evaporated milk or 8 *level* tablespoons powdered whole milk	480	16	20	24	330
1 slice	Bread	25	2	--	13	60
1 teaspoon	Butter	5	--	4	--	30
			69	52	107	1115
-----------	Bacon	------	------	------	------	------
-----------	Potato	------	------	------	------	------
-----------	Milk	------	------	------	------	------
-----------	Orange	------	------	------	------	------
-----------	Bread—sliced	------	------	------	------	------
-----------	Butter, tablespoon	------	------	------	------	------

Sample Menu

Morning

1 orange
½ cup cooked oatmeal
¼ cup milk
1 egg
slices bread
tablespoons butter

Noon

1 average serving meat or fish (3 oz.)
½ cup 5 per cent vegetable
½ cup 10 per cent vegetable
1 orange*
slices bread
tablespoons butter

Night

1 small serving meat or fish (1½ oz.)
½ cup 5 per cent vegetable
½ cup 10 per cent vegetable
1 orange
slices bread
tablespoons butter
¾ cup milk†

*Midmorning**

1 orange

Midafternoon†

¾ cup milk

Bedtime

1 slice bread with 1 tsp. butter

*Orange may be omitted from noon meal and taken at midmorning if desired.
†Milk may be omitted from night meal and taken at afternoon if desired.

TABLE 81

ADDITIONAL FOOD ITEMS FOR ADJUSTING THE DIET

Household Measure	Food	Gram Weight	Protein	Fat	Carbohydrate	Approximate Calories
1 slice	Bread, sliced	25	2	–	13	60
1 tablespoon	Butter	13	–	11	–	100
2 long strips (cooked crisp)	Bacon (raw: $9 \times 1\frac{1}{2} \times \frac{1}{8}$)	15	3	10	–	100
1 medium sized	Potato	120	3	–	22	100
$\frac{1}{2}$ pint (1 cup)	Milk	240	8	10	12	165
$\frac{1}{4}$ cup	20% cream	60	1	10	1	100
$\frac{1}{4}$ cup	40% cream	60	1	21	2	200
1 small	Orange	100	1	–	10	45

In the preceding specific prescription the necessary additions to the basal outline could be determined as follows:

	Calories	gm. of P.	gm. of F.	gm. of C.
Desired	2,000	75	100	200
Basal outline	1,115	69	52	107
Additional	885	6	48	93

If, for example, the following additions were made to the basal diet:

	gm. P.	gm. F.	gm. C.
3 oranges	3	–	30
2 slices bread	4	–	26
3 tbs. butter	–	36	--
1 cup milk	8	10	12
1 medium potato	3	--	22

18 gm. protein, 46 gm. fat, and 90 gm. carbohydrate would be added. This would result in a total sufficiently close to the calculated prescription to be entirely satisfactory. Variations in composition preparation and measurement of food, as well as changes in body needs, make closer check between the prescription and its fulfillment unnecessary. The suggested addition would give three generous servings of fruit daily, a sandwich at noon if desired or if the lunch must be "carried," enough fat to permit some conversion into salad dressing, more adequate milk intake, and the potato which is usually so difficult to forego. Other combinations are possible and the substitutions are many.

While it is more accurate to measure food by weight than by volume or visual estimation, it is not always practical to do so in the home. It is desirable, however, to begin the diet with weighed

portions, if possible, and to check occasionally one's accuracy by weighing the prepared portions. Special scales are available (see Fig. 80.

During the last several years the "unrestricted" or "free" diet has come into use—a program which has been tried for a dozen years in Europe. This program permits the patient to eat what and how much he pleases "within reasonable limits" with adequate insulin coverage. In order to prevent hypoglycemic shocks, there needs to be a fairly continuous glycosuria. This condition, the supporters of this regime contend, is not harmful. The old idea that it was undesirable arose from animal experiments carried out before the use of insulin. Actually these diets are not wholly unrestricted. The children on whom they have usually been tried have "judicious supervision" of their food habits—first in the hospital and later in the home. However, they are permitted leeway in order to satisfy their own individual tastes. Overindulgence is not permitted. Freedom in choice is permitted only after the child had become familiar with the general principles of nutrition and diabetic control through instruction and initial ingestion of a prescribed measured diet. Fairly regular food habits seem to be the rule, in the studies so far carried out, once the restrictions are lifted.

At intervals during the year, the patient is asked to keep a week's record of his food intake. This is analyzed by the dietetian and necessary adjustments or advice are given. Urine tests for sugar and acetone are those followed by all diabetics.

An added advantage is the increase in food intake following exercise, which compensates for the lowered blood sugar at such time. This is important for active children.

The major advantage, however, is psychological. Most individuals are happier with a minimum of restriction and rules. There is less worry and nagging on the part of the mother of a diabetic child, less resentment and desire to cheat, with the feeling of guilt which accompanies such action. It is an experiment well worth following. With intelligent patients, it would seem to have definite advantages. As one physician put it, patients who broke diet almost constantly, frequently got along "irritatingly" well. Perhaps the strict control which has been practiced is not necessary.

The insulin dosage, frequently protamine and regular, given in a single morning dose, is adjusted to cover the carbohydrate need for the diet which is generally ingested.

The outline of diet for a diabetic patient suggested in Table 80 conforms essentially to the outline for normal diet. The adjustments of lowered carbohydrate and increased fat intake is brought about by increased use of butter, simple curtailment of cereals and cereal products, and the use of the 20% vegetables, by the omission of sweets and the use of fruits for desserts. For simplicity the fruit is expressed as an orange and the cereal as oatmeal, etc., but substitutions can be made by reference to the substitution sheet in the Appendix Table 103.

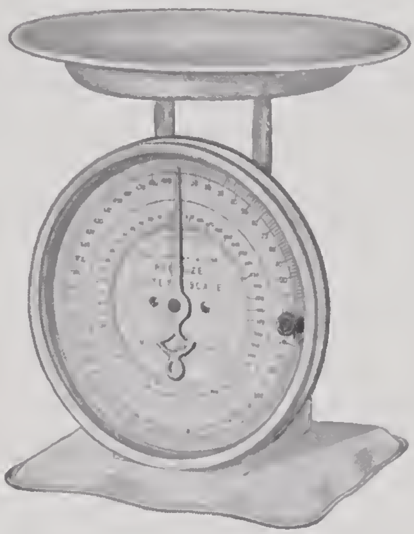


Fig. 80.—Scales for weighing food. (Courtesy Pelouze Manufacturing Co., Chicago.)

The meal schedule may need alteration as indicated in the basal outline. The adjustment in number of meals depends largely upon the type of the insulin used—when the peak of its action occurs. Protamine insulin, with its prolonged action, may necessitate a slight decrease in the amount of food eaten in the usual three meals a day, and an addition of a midmorning, midafternoon, and bedtime meal. This scheme is suggested in the diet outline. These supplementary meals, with the three approximately equal major meals, regulate the blood sugar level more satisfactorily, especially in children, and thereby act as a preventive against insulin shock. The occurrence of shock or the absence of it will further determine the advisability of these in-between meals. Just an afternoon lunch and one at bedtime

may suffice. For the adult the bedtime lunch, containing approximately 150 calories, is usually sufficient. If plain insulin is used, these additional meals may be omitted and the food may be added to the three main meals.

In the outline given, no "diabetic" foods have been included. Such foods are costly and unnecessary because they change the "adjusted" food intake to a "special" diet. The diabetic foods are essentially starch free (gluten bread) or sugar free. Gluten (a protein) must be considered as 50 per cent sugar and, therefore, cannot be eaten at will. Except where saccharine is desired, the diabetic person is wiser to acquire a taste for less sweet foods or drinks.

The satiety value of the diet is of importance. It is not reasonable to expect exact food intake always to be enjoyable—and meals should be enjoyed. Therefore, the unrestricted use of certain foods is desirable—and those whose nutritive value is low may be so used. Bouillon, consummé, clear tea and coffee, 5 per cent vegetables and vegetable juice, and unsweetened gelatin, are among such foods.

If it is necessary at any time to substitute a liquid diet for the usual diet, such a step is possible, as shown in Table 82. A prescription for 2,000 Cal., 75 P., 100 F., and 200 C. might be filled as shown. These items could be used as eggnog and fruit juice.

TABLE 82

A LIQUID DIET

	P.	F.	C.
1 quart milk	32	40	48
8 tbs. (level) powdered whole milk	16	20	24
3 eggs	18	18	—
½ c. coffee cream	2	20	2
3 tbs. sugar	—	—	45
8 oranges	8	—	80
	76	98	199

Any desired prescription may be handled in this way. For suggestions see Chapter XXVII. Any adjustment in bulk, smoothness, blandness, or for age, is made in the same way a normal diet is adjusted.

The use of the liquid diet during temporary illness may be very helpful, particularly in the control of the diabetic child.

Failure to eat interferes with the usual insulin response which is also affected by metabolic disturbances. This combination of factors can make control extremely difficult. If the food intake can be held at a reasonably constant intake, return to good control is greatly simplified.

The difference between diet prescriptions for the diabetic adult and diabetic child is that the adult is more satisfactorily treated by calorie intake somewhat below that for the normal of the same age, sex, occupation, and size (the diabetic adult may well be held 10 per cent below average weight), but the child must have a diet that is entirely adequate. The adult caloric ratio could be 10 per cent protein, 45 per cent fat, and 45 per cent carbohydrate. The child's protein intake should be at a 15 per cent level. Three cups of milk should be included and some source of vitamin D. Obesity is a predisposing factor in diabetes, and when it still exists at the time dietary treatment is instituted, it must be taken into consideration. Unwanted weight gain or loss not due to a misunderstanding of the diet prescription indicates that the caloric intake needs adjustment. An exact estimation of caloric requirement is not easy to establish immediately because of the difficulty in making proper allowance for activity. Exercise decreases the need for insulin by facilitating the burning of blood sugar.

After the diet is calculated, the insulin dosage is adjusted in amount and distribution to assure normal utilization of carbohydrate, as evidenced by a normal blood sugar level, an essentially negative urinary sugar (absence of glycosuria), and the absence of ketone bodies in the urine. The dosage in units will equal approximately one-half the number of grams of sugar excreted in the urine when no insulin is given. Obviously careful adjustment must be made in the individual case, just as dietary adjustment must be made to personalize the diet itself.

As reference, the following data are offered under this discussion.

Overdosage of insulin results in hypoglycemia or low blood sugar with its chain of symptoms which have been outlined in Table 83.

Insulin shock may occur with great suddenness, and no person suffering from diabetes should ever be without an available source

TABLE 83

SYMPTOMS OF INSULIN SHOCK

The early symptoms of insulin overdosage include:

1. An unaccountable restlessness and sensation of impending trouble, associated with a feeling of tremor in the extremities.
2. Marked hunger, with weakness and fatigue.
3. Perspiration, which is often profuse.
4. Pallor; or, sometimes, flushing of the face; and dilated pupils.
5. Increase in pulse rate, up to 110 to 120 beats per minute.

If these warning signs are disregarded, more serious symptoms develop, such as:

1. Disturbed vision.
2. Dizziness.
3. Aphasia and loss of memory.
4. Emotional excitement, disorientation, and delirium.
5. Incoordination of the muscles.

These will be followed by:

1. Marked lowering of the blood pressure.
2. Collapse.
3. Unconsciousness.
4. Death.

of sugar. If sugar is taken when the first symptoms arise, it will frequently avert the shock. The identification card stating that the bearer is diabetic and giving his name, address, and the name of the clinic or physician responsible for his care, is another wise precaution. It may prevent misinterpretation of his condition.

Hypoglycemia may also result from incorrect distribution of insulin in relation to meals, excessive exercise which reduces blood sugar, or decreased food absorption when a meal is missed or when vomiting or diarrhea occurs.

One might differentiate between these symptoms which occur with regular or crystalline insulin having a time range of four to six hours, those which occur when globulin insulin is used with a range of eight to ten hours, and those of the slower acting protamine zinc insulin with a time range of eighteen to thirty-six hours. The symptoms of inadequate blood sugar following the use of protamine zinc insulin ("P. Z. I.") tend to come in the early morning hours before breakfast and are more insidious. Headache, weakness, depression, confusion, and sometimes nausea, are not uncommon, although at times patients awake with the sharper symptoms of tremor, sweating, and hunger.

Hyperglycemia, conversely, is high blood sugar and indicates incomplete carbohydrate combustion with potential ketosis and coma. It results from inadequate dosage of insulin, overindulgence

in food, infection which lowers sugar tolerance or erroneous omission of insulin in any case of illness where diet is restricted under the mistaken idea that only when the full diet is being ingested should the full amount of insulin be taken. It should be well understood that when food is not eaten body tissues replace the food source of energy, and at least one-half of the usual amount of insulin will be needed.

Simple ketosis is evidenced merely by the presence of acetone bodies in the urine, and it is readily overcome by proper dietetic supervision.

The early symptoms of a dangerous ketosis are usually of a positive nature, consisting of nausea, colic, and abdominal pain, and especially sudden lack of appetite in a person who previously had a large one. Breathlessness and air hunger are more serious symptoms. Drowsiness is very common.

The unconsciousness of diabetic coma must be differentiated from the unconsciousness of insulin shock, since the treatment of the two conditions is exactly opposite, and delay in treatment of either may result in a fatality. Insulin shock comes quickly; coma develops over several hours.

TABLE 84

DIFFERENTIAL DIAGNOSIS OF DIABETIC COMA AND INSULIN SHOCK

DIABETIC COMA	INSULIN SHOCK
Cause	
Increase of diet	Reduction of diet
Omission of insulin	Increase of insulin
Infection	Increase of exercise
	Failure of absorption of food
History	
Gradual loss of consciousness preceded by vomiting	Rapid loss of consciousness sometimes followed by vomiting
No convulsions	Convulsions
Physical Examination	
Skin dry and flushed	Skin moist and pale
Breathing hyperpneic	Breathing shallow
Pulse feeble	Pulse full and pounding
Laboratory Examination	
Blood pressure low	Blood pressure normal or high
Blood sugar high	Blood sugar low
CO_2 under 20 volumes per cent	CO_2 normal or elevated
Diacetic acid	No diacetic acid
Urine sugar	Urine negative or the second specimen negative

Although the diagnosis of these two conditions can be made from laboratory data, the history and physical examination will give presumptive evidence while waiting for laboratory reports, or even more important, if they cannot be obtained.

Repeated urine tests for sugar are of value in differentiating.

Laboratory tests are of extreme value in determining the treatment of the diabetic person. With hospitalization the carbon dioxide level of the blood may be followed as a measure of ketosis change. This is of value during recovery from coma if alkali treatment has not been given and, as shown above, this carbon dioxide level is a differential between coma and shock. Routine tests for the ambulatory and the bed patient consist in measurement of the blood and urinary sugar levels, and of urinary ketone bodies. In the home the daily routine is the determination and recording of urinary sugar by the Benedict test, and at times testing for the presence of diacetic acid, one of the ketone bodies. Diacetic acid (or acetoacetic acid) betahydroxybutyric acid, and acetone comprise the "ketone bodies."

TABLE 85

QUALITATIVE ESTIMATION FOR SUGAR IN THE URINE

Place 5 c.c. (1 teaspoonful) of Benedict's solution in a test tube and add exactly 8 drops of the urine to be tested. Shake gently and heat over a free flame allowing it to boil one minute. The tube may be heated in vigorously boiling water for five minutes with the same results. Allow the tube to cool spontaneously. The color reactions shown in Fig. 83 indicate the amount of sugar present.

Color change also expresses the extent to which ketone bodies are excreted in the urine. The appearance of these bodies is a danger signal, a warning of impending coma.

TABLE 86

GERHARDT'S TEST FOR DIACETIC ACID (ACETOACETIC)

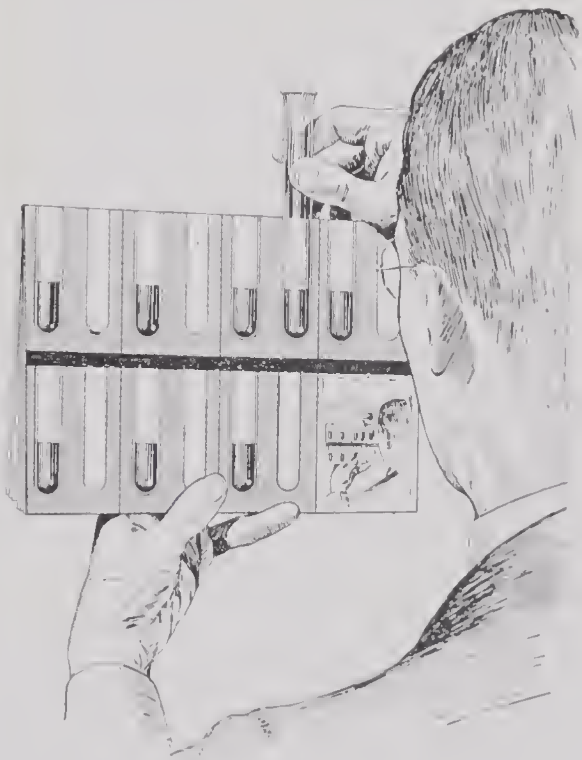
To about 5 c.c. fresh urine in a test tube add carefully, drop by drop, a 10 per cent ferric chloride solution until no more precipitate forms. A red (Burgundy urine) color indicates the presence of diacetic acid. Diacetic acid is unstable on boiling. Divide specimen into two tubes, boil one and compare to the unboiled sample. If color was due to diacetic acid the color will disappear. If the color was due to a drug, color will remain though change may take place. This is the test commonly used inasmuch as diacetic acid is the easiest one of the ketone bodies to detect.

Fig. 81.—The qualitative Benedict t

Fig. 3
0.1 Per Cent Sugar (+)

Fig. 4
0.5 Per Cent Sugar (+ +)

Fig. 7
Over 10 Per Cent Sugar



of Dr. F. B. Peck, Eli Lilly and Co.)

Review Questions

To which of the three is the term "diabetes" commonly applied?

What are the symptoms of diabetes mellitus?

To determine the total glucose or fatty acid available to the body from ingested food, what calculation must be made?

Why is the fatty acid to glucose (FA:G) ratio important?

What ratio is considered definitely ketogenic?

What is the normal amount of glucose in fasting blood?

Why is the level higher in a diabetic person?

At what level does sugar appear in the urine?

Approximately how much glucose will one unit of insulin oxidize?

What four types of insulin are available?

What is the most important factor in the treatment of diabetes?

What three types of diet have been advocated?

What percentages of protein, fat, and carbohydrate seem to be a satisfactory distribution?

In what respects does this distribution differ from the normal diet?

Using these percentages, figure a diet prescription for a diabetic whose ideal weight should be 60 kilograms.

In what ways does the outline for a diabetic patient given in Table 80 differ from the normal diet?

What is the essential difference between a diabetic prescription for an adult and for a child?

What are the symptoms of insulin shock?

What precaution should be taken by the diabetic to avert shock?

What are the symptoms of ketosis or the approach of diabetic coma?

What is the Benedict qualitative test for sugar in the urine?

What is the Gerhardt's test for acetoacetic acid?

CHAPTER XXIX

HYPOGLYCEMIA OR HYPERINSULINISM

The elevation of blood sugar which arises from the ingestion of food normally is followed by an increased insulin which in turn brings the blood sugar back within the normal range. When the mechanism is excessively sensitive or liver glycogen function is impaired, abnormal blood sugar levels result. When there is overproduction of insulin the blood sugar falls to levels lower than normal and a chain of symptoms results, just as symptoms always occur when any blood constituent is beyond normal range. Individuals so afflicted become weak, sweaty, hungry, or nauseated, and may even lapse into a sleeplike unconsciousness or convulsions. The feeling of almost constant hunger has led to the name "hunger disease." The condition is the antithesis of diabetes—it is an oversecretion of insulin (a hyperinsulinism), resulting in a low blood sugar (hypoglycemia) instead of an undersecretion (hypoinsulinism) which, of course, will result in hyperglycemia.

Hyperinsulinism has probably existed as long as diabetes, but its symptoms are such that it was easily attributable to nervousness. It was described as a disease entity in 1925 by Seale Harris. Evans and McDonough wrote in 1933 that "hyperinsulinism takes another syndrome from the wastebasket of neuroses." Some cases of hyperinsulinism were originally believed to be epilepsy, and cases of mental deficiency and degeneracy have been explained on this basis.

It has been suggested that basically the same cause may result in either hypo or hyper production of insulin, that is, in dysfunction of the islet cells. Tumors of the islands of Langerhans occur and result in an increasingly intractable hyperinsulinism. Removal of the tumor has resulted in a cure. Cases of hypoglycemia have been reported in individuals having histories of previous hyperglycemia, suggesting that the original dysfunction was overactivity, and that underactivity was the sequence. The individual suffering from hyperinsulinism is a potential diabetic because prolonged overfunctioning of the islet cells may result in their exhaustion. A familial tendency exists with this condition as well as with

diabetes. Or one member of a family may exhibit one condition and another member the other. Occasionally pancreatic tumors or cancers or severe liver damage are the exciting cause—conditions which bring about overproduction of insulin or altered liver glycogen formation. Pituitary or adrenal malfunction can alter blood sugar levels as can lesions in the central nervous system.

The **symptoms** accompanying hypoglycemia, which are the same that occur in insulin shock, are due to low blood sugar. They usually occur about three to four hours after a meal, and are relieved by food. Exercise and emotional upsets exaggerate the condition. If one studies the blood sugar curve in this condition, the picture indicated in Fig. 82 is seen. In mild cases the low level ranges between 60 and 70 mg. per cent; in moderately severe cases, between 50 and 60 mg. per cent; and in severe cases, it may range from 50 down to 30 mg. per cent. When the level reaches 50 mg. per cent, convulsions usually occur.

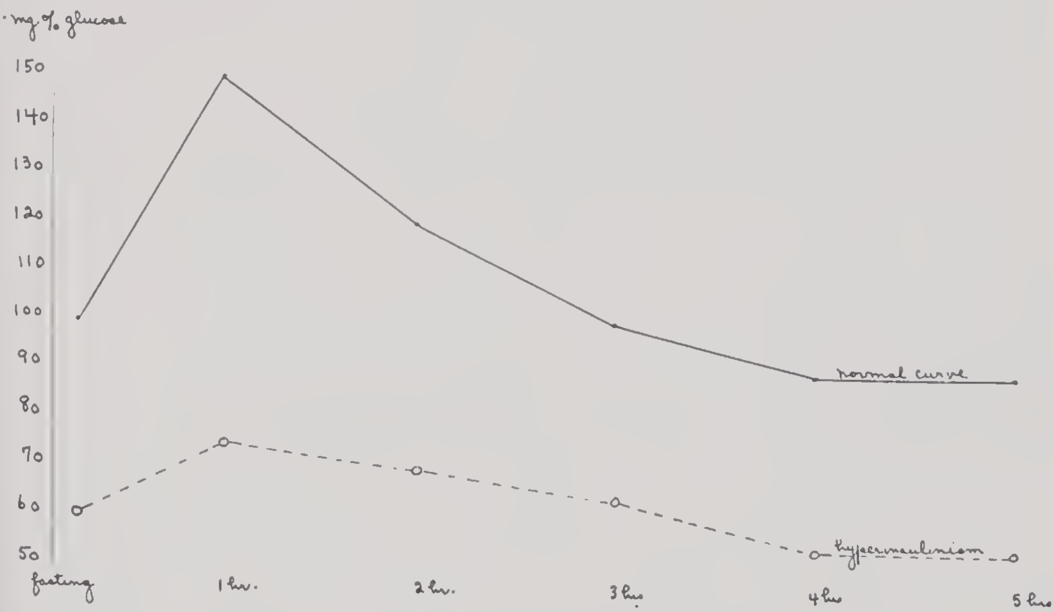


Fig. 82.—Contrast between the blood sugar curve following food ingestion in health and when there is hypersecretion of insulin.

A tentative diagnosis may be made from the history in which hunger, weakness, nervousness, mental lapses, particularly if consciousness is lost or convulsions are described. The diagnosis is confirmed by the blood sugar curve.

Dietary adjustment proves to be a satisfactory method of treatment in the majority of cases. Diets high in protein and fat and low in carbohydrate are used.

For example, a 3,000 calorie diet prescription *might* be written 150 gm. P.—200 gm. F.—150 gm. C., or a 20 per cent P., 60 per cent F., 20 per cent C. ratio. It might even be higher in fat and lower in carbohydrate. The diet may contain 120 to 150 gm. P., 50 to 75 gm. C., and sufficient fat to make up the needed calories. This in contrast to a normal which might be 100 gm. P., 100 gm. F., and 350 gm. C. Such adjustment from the normal may be made by curtailment of cereals and cereal products and the 20% vegetables, omission of all sweets, and abundant use of the 5% vegetables and of fats. As an example, a 2,400 calorie diet may be planned from the following food list:

TABLE 87

1 quart milk + 12 tbs. powdered skim milk
½ cup 20% cream
2 small oranges
2 pieces sliced bread
1 cup 5% vegetable
1 cup 10% vegetable
3 eggs
4 ounces lean meat
4 tbs. butter
4 strips bacon (4½ by ⅛ inches)
source of vitamin B complex

Mix milk and powdered skim milk and use mixture rather than the two separately.

The following use of the above listed foods is suggested:

Morning	*Noon*	*Night*
Bacon and egg Slice bread and butter Glass of milk	Meat, fish, or egg ½ cup 5% vegetable as salad ½ cup 10% vegetable Milk or ½ slice bread and butter Fruit	Same as noon meal

Between meals

Glass of padded milk at 10, 4, and bedtime, or
Slice of bread and butter

The food interchanges suggested in the Appendix (Table 103) may be applied here as well. Such a menu will provide approximately 20% of the calories as protein, 60% as fat, and 20% as carbohydrate.

To decrease the carbohydrate intake, rather than to increase it, in an attempt to elevate the blood sugar level, seems paradoxical. In fact, control is attempted by some clinicians by the frequent ingestion of high carbohydrate diet, including a carbohydrate

drink between meals, and this treatment is effective in some instances when the hypoglycemia is not due to uncomplicated overactivity of the insulin forming cells. However, the more successful method is the reverse: the curtailment of the carbohydrate intake on the premise that if carbohydrate is decreased in amount, there is a tendency to decrease insulin production. Curiously enough, commercial insulin injected into some hypoglycemic patients with only mild symptoms has resulted in a further depressant action on the blood sugar. Such treatment must be carefully supervised by the physician in order to prevent insulin shock.

The high protein intake is stressed on the assumption (not without proof) that it will release glucose to the blood stream at a much slower rate than carbohydrate ingested as such—and without any pancreatic stimulation. It will be remembered that protein in its metabolic breakdown yields 50 per cent of its weight as glucose. See page 52. The release of this glucose to the blood is far less rapid than the quick absorption of the glucose from ingested carbohydrate with its attendant increase in blood sugar level. Protein must first be split into the amino acids, be absorbed as such into the blood, and be carried to the liver where further splitting action releases the carbohydrate. Hence no significant elevation of blood sugar occurs.

The characteristics of the diet for hypoglycemia are:

All *sweets* as candy, desserts, jelly, etc., are eliminated.

The *cereals* and cereal products, including bread, are curtailed—but one serving of this group is usually taken at any one meal. It is important that cereals should be sufficiently salted when cooked—proper salting brings out the natural sweetness.

Meat, fish, fowl, eggs, or cheese in moderation is allowed at each meal.

Milk, 1 pint to 1 quart of milk depending upon the food requirements. The addition of powdered skim milk or Casec is an excellent means of increasing the protein level.

Fats, butter, cream, and mayonnaise will vary in amount, the amount depending on the individual's needs. Their use makes palatable the generous use of the leafy vegetables which form such a large portion of the diet.

Vegetables. The diet contains a larger quantity of vegetables than the diet which is usually consumed by the average individual.

Vegetables are included in both the noon and the evening meal. Due to this fact, the noon and evening meals are essentially the same. Vegetables may be conveniently grouped according to the carbohydrate content into 5, 10, 15, and 20% groups. The choice of the vegetables is optional. The diet specifies only that a definite amount of one or more groups of vegetables be eaten at a meal. The vegetables in 5 and 10% groups are most commonly used, the 15 and 20% groups only when the bulk of the diet must be small.

Fruits are usually included in the diet 2 or 3 times a day. These provide the only "sweet" which the child on this diet should have. It is possible to buy, or to can at home, all fruits without sugar. Saccharin is permissible in such fruits as cranberries and gooseberries and in rhubarb, but, in general, unsweetened fruit is to be preferred. One quickly becomes accustomed to the natural sweetness and ceases to desire additional sugar.

As with vegetables, fruits of high carbohydrate content may be used when quantity intake must be small or for variety, but it should be remembered that since the carbohydrate content is high, caution must be exercised in their use.

Fruits are also classified into percentage groups, but the measurement of fruits is more difficult since fruits are frequently eaten whole. Therefore the interchanges suggested are more usable than such a percentage grouping. The size of the serving indicates the carbohydrate concentration.

Since the fruit of the diet yields sugar almost exclusively, the total grams of sugar from this source is usually, for convenience, expressed in terms of a small orange (No. 216) weighing about 4 ounces. From this any desired substitution can be made.

Miscellaneous: In adition to the foods listed, clear soup, lettuce under salad, garnish as watercress, pepper, parsley, chopped pickle, etc., may be used. Coffee and tea should not be given to children but are allowable for adults.

It is perfectly possible to provide a diet which is attractive and varied, if thought is given to its preparation.

For variety, fruit may be combined with diabetic gelatin (a specially prepared gelatin which has no food value) into salads and desserts. Fruit and cream make delicious mousse. Several fruits may be mixed in a fruit cup or salad.

Eggs, milk or cream can be made into custards of various kinds and flavors, Bavarian creams, or sponges through the use of diabetic gelatin.

Vegetables can be cut up into soups, made into cream soup, salads, or stews with the meat. They can be baked, boiled, creamed, or steamed; a variety of sauces and combinations are possible, while a number may be eaten raw.

Cheese can be used in numberless ways—sauces, salads, crackers and cheese for dessert, soufflés, combined with cereals, etc.

Meat and fish can be varied by preparing as hash, salads, creamed with the milk or the cream of the diet, made into stews, loaves, or combined with cereals, obtained by bread substitution, and vegetables into casserole dishes.

The addition of chives, parsley, watercress, chopped onions and peppers, flavoring and coloring matter changes not only the flavor but the color, a scheme of value in feeding children.

The bulk of the diet may be regulated by the quantity division between the various vegetables. For example, 2 cups of 5% vegetables have the same dietetic value of 1 cup of 10%, ¾ cup of 15%, ½ cup of 20%. Choice is governed by personal preference in eating, appetite, or variety. The same variation may be made with fruits if great care is used.

If the equivalent of the food suggested for a meal is contained in the meal, the manner of serving is optional and dependent entirely upon the ingenuity of the meal planner.

Review Questions

What is hypoglycemia or hyperinsulinism?

What are the symptoms? When do they occur?

Is this a new disease? Explain.

What may be some of the causes?

What is the normal amount of glucose carried in the blood?

What are the ranges in hypoglycemia?

How does the blood sugar curve in this disease differ from that in health after the ingestion of food?

What is the treatment for hyperinsulinism?

How do the percentages of protein, fat, and carbohydrate in the diet differ from the normal?

What is the theory of reducing carbohydrate when elevation of blood sugar is desired?

What is the effect on blood sugar of ingested protein? Why?

CHAPTER XXX

GOUT

Gout is a metabolic disturbance in which uric acid is excreted with difficulty by the kidneys, the acid is raised to a high level in the blood, and as a consequence the sodium salt of the acid (sodium urate) is deposited in various parts of the body. This abnormality, Hench suggests, is probably a result of, rather than the cause of, gout. Gout occurs predominantly in men, is usually associated with overweight, has its onset around or after middle life, and is markedly hereditary in occurrence. The attack, which appears as an inflammatory process, is characterized by swelling, local heat, redness, and pain in one or more joints. The great toe, especially, is involved. Eventually permanent changes result from gouty deposits.

Uric acid is a normal constituent of blood, arising from two sources—exogenous or from food, and endogenous or from the body's own tissues. It arises from the breakdown of nucleoproteins (see Chapter IV, Proteins) of plant and animal cells. Nucleoprotein, as a result of the metabolic process, is broken down into purines, which in their turn are oxidized to uric acid. Under ordinary conditions the body readily excretes the excess uric acid in the urine, but in gout, for some obscure reason, excretion is impaired. The endogenous uric acid cannot be altered, since breakdown of body tissues goes on throughout life; the exogenous fraction can be controlled by diet. The diet used in gout has, in the past, been planned to be low in fat, essentially free from purines, and only moderately high in total protein; and this continues to be the generally accepted dietary today.

Glandular organs, liver, kidney, sweetbreads (thymus and pancreas), are especially rich in nucleoproteins. Muscle meats are relatively rich, as is the germ of grains and the actively growing part of plants, such as the tips of asparagus, the sprout of grains or beans, etc. Most vegetables are essentially purine free; fruits and the milled grains or cereals are entirely so. Inasmuch as the germ is attached to whole grain cereals, in this form, they are precursors of purines. Milk is purine free as are also hens' eggs.

The outline below indicates the dietary changes used in the treatment of gout. Table 108 in the Appendix gives details.

From the tabulation it was evident that meats, fish, and poultry must be strictly limited, while glandular meats must be eliminated entirely. Protein must be derived almost entirely from milk and egg. For palatability a small serving of muscle meat is permitted once or twice a week, possibly leading up to daily use, depending upon how drastically the diet must be curtailed. Finely milled cereals and fruits are consumed as desired, as may vegetables with the exceptions noted above. The normal diet contains from 600 to 1,000 mg. of purines daily; a low purine diet contains from 100 to 150 mg.

TABLE 88

Omit:	Purine content high. Liver, sweetbreads, kidney, sardines, anchovie, squab.
Only as directed:	Purine content considerable. Beef and veal, mutton and lamb, pork and pork products, game and fowl of all kinds, fish and shellfish of all kinds, meat extracts or gravies, fish pastes, beans (except string beans), peas, lentils, spinach, mushrooms, whole wheat or graham breads, whole wheat cereals, oatmeals.
Eat freely:	Foods of low purine content. Milk, cheese, butter, eggs, mayonnaise, vegetable oils, all fruits, vegetables, except those listed alone, all breads, cereals, cakes, cookies, etc., prepared from white milled flour, sweets, sugar, nuts, gelatin, ice cream, tea, coffee, cocoa in moderation.

Further restrictions are thought to be of clinical value, namely, a total caloric intake decreased somewhat below the normal value for the individual when in health. A slight state of undernutrition is much to be preferred to obesity. A weight below normal by 10 to 15 per cent is satisfactory. High caloric intake, regardless of type of food ingested, predisposes to attacks, which is an added reason for caloric restriction.

The total protein level for the patient with gout is planned not to exceed 1 to 1¼ gm. per kilogram of body weight. High protein, even though it is purine free, tends to raise the uric acid level of the blood. Restriction of fat appears also to be of value in decreas-

ing the severity and the frequency of the attacks. Coffee and tea, while their caffeine content probably is not converted into uric acid, are wisely limited to one cup daily. Alcohol in any form aggravates the disturbance and should be sharply curtailed. Rich, highly seasoned foods should be avoided, as should gravies, meat broth, and meat stock soups. Sodium chloride should be used sparingly and water should be taken in abundance. Last, but by no means least, the diet should be continued in conjunction with strict adherence to general rules of health.

Recently, Bauer and Klemperer, writing in Duncan's *Diseases of Metabolism,** question the need of such drastic dietary restrictions. They contend that nowhere have they found sufficiently well-controlled dietary studies involving uric acid levels, dietary changes, and the clinical course of the disease. Their treatment is avoidance of overweight and a diet which contains adequate amounts of protein, iron, and vitamins. They feel that drastic curtailment of purine intake results in a "monotonous and unpalatable diet" as well as one conducive to the development of deficiencies. They restrict only excessive purine intake through the avoidance of:

Sweetbreads	825 mg. per 100 gm.
Anchovies	360
Sardines	300
Liver	230
Kidney	200
Brains	195
Meat extracts	150

Since the values given for the purine value of foods in their opinion are controversial, and since the amounts, other than those indicated above, are small, they can be neglected in the diet planning. They even permit small amounts of alcohol. The preferable type of treatment, therefore, is still open to question.

During an attack of gout, which is usually of short duration, the diet adjustment may need to be drastic. At this time it should consist of a moderate amount of skim milk, an abundance of fruit and fruit juices, cereal with milk, crackers, and large quantities of water. When the attack is over, the diet outlined in the general discussion should again be followed rigidly.

*W. B. Saunders Co., 1947.

Review Questions

What is gout?
What are the characteristics of gout?
What are the sources of uric acid in the blood?
What adjustments of diet are necessary in treating gout?
What foods are highest in purines?
What foods must be eliminated entirely?
What foods may be eaten freely?
Should the diet be high or low in calories?
What level of protein is advisable?
With what foods can this level be maintained?
Are coffee and tea allowed? Alcohol?
During an acute attack what type of diet is advised?

CHAPTER XXXI

THE DIETARY MANAGEMENT OF FEVERS

A febrile condition which is of short duration (under two weeks) requires only such adjustment as is most satisfactory to the patient, and a liberal water intake and some fruit juices to prevent dehydration and acidosis. If the probable duration of the fever is longer, then adjustments must be made in the diet so that the food will be suitable and adequate for the individual and for the specific condition. The general characteristics of the diet in fevers are the same for all of them. Specific alterations will be noted later. Depending on the severity of the illness and the seat of infection, food of suitable consistency should be chosen. Usually only a liquid, semiliquid, or soft diet is served. Gastrointestinal rest may be of value and probably would never be contraindicated. Many times, however, the illness will be such that the diet for convalescence may be used throughout the indisposition; for instance, in tuberculosis.

Fever is caused by imbalance between heat production and heat elimination. For every degree Centigrade increase in body temperature above normal, there is a 13% increase in metabolic rate. Thus, a temperature elevation of 37° to 40° C. will result in an increased caloric need of about 40%. But other factors may be operative. DuBois suggests that the requirement may be calculated by determining the normal metabolic rate according to age and sex, adding 13% for every degree of fever, and 10% more if there is toxic destruction of body tissue (see paragraph below), and then adding from 10 to 30% for the restlessness of the patient. Thus the increased need of a bed patient with fever may be as high as 60% above basal. As has been said repeatedly, good nutrition is the goal in all conditions, and it is essential in combating any disease. Therefore, the need for approximate caloric balance is apparent. Reference to the general discussion on diet therapy in Chapter XXVI shows how this may be accomplished.

Protein metabolism is increased in fevers, depending upon the grade of infection more than upon the hyperthermia (fever) and its resulting metabolic increase. The breakdown of body protein due to the activity of toxic agents is spoken of as toxic destruc-

tion of protein. The extent of the breakdown depends on the causative agent and the grade of infection. (See discussion of high protein diets.)

The protein intake should be sufficiently high to enable the patient to maintain nitrogen balance, a condition signifying that body tissues are not being depleted. A diet sufficiently high in calories and in carbohydrates contributes toward this end. Carbohydrate is increased for several reasons. It more effectively spares protein than does fat, it combats acidosis, and it is well tolerated. Moreover, carbohydrate stores (glycogen) are quickly exhausted. The glucose of the blood is dependent upon the glycogen, and is the most readily available source of energy. Quantities of carbohydrate are, therefore, required to maintain the glycogen and blood glucose, and may be administered in the form of gruel, cream soup, fruit, fruit juice, in plain or reinforced form.

The fat level should be essentially normal in amount, unless the caloric level is such that carbohydrate alone cannot supply the additional calories. Egg yolk, cream, and milk, with some butter, are the preferred sources of fat.

Fever and metabolic increase bring increased water loss, and if dehydration is to be avoided, liberal amounts of water are necessary. Vitamin need is increased by hypermetabolism.

Bulk content should be no greater than that allowed in a diet for convalescence, and it may need to be lower than this or entirely eliminated, as in the liquid diet, depending upon the character of the illness.

Acid-base balance should be on the alkaline side (except in rare instances) in order to maintain the alkaline reserve.

The salt intake (NaCl) is important inasmuch as more than normal amounts will be lost in perspiration. Liquid diets will be low in sodium chloride unless care is taken to include salt-containing foods, such as broths and soups. It may be wise to add salt to all foods where it will not cause lack of palatability.

The ketogenic-antiketogenic balance may need to be ascertained if fat ingestion is at a high level. See Table 99 for possible abnormalities in utilization.

Attractiveness and palatability of the diet are all important. Too frequently lack of appetite is a serious complication. Personal preferences and food habits should receive consideration.

Typhoid Fever

In certain febrile conditions dietary treatment is of more than usual importance. Our knowledge of the importance of diet in fevers has been broadened by the work on typhoid fever carried out at the Russell Sage Institute. Experiments there indicated that a 23 to 44% metabolic increase exists in typhoid fever. The older type of diets which supplied from 300 to 500 calories daily, on the premise "starve a fever," resulted in such emaciation that convalescence was much hampered. The diets proposed by Shaffer and Coleman in 1908 and 1909 completely revolutionized the treatment of typhoid. Their diets were calculated to contain 3,000 to 5,000 calories daily. Protein destruction in this disease is about three times the "wear-and-tear" quota of health, and increase in protein intake must be provided to meet it. Roughly 1.5 to 2 gm. per kilogram will accomplish this if there is also an increase in calories and carbohydrate. Twice the normal caloric requirement will be adequate, or 60 to 80 calories per kilogram, according to Coleman.

Typhoid fever is a general, infectious disease, with specific manifestations in the intestines, the early appearance of Peyer's patches, with subsequent necrosis and ulceration. Liver and gall bladder changes follow. The diet is necessarily liquid at first, then semisolid, until convalescence is complete. It must be devoid of roughage. Excess carbohydrate is preferred to excess fat for the extra calories needed, as already explained. The foregoing general suggestions for diets in febrile diseases also apply to typhoid fever.

Coleman has found that the duration of the disease is shortened, the diarrhea is lessened, weight loss is prevented, and hemorrhage and perforation are less frequent, mortality is decreased, and convalescence is shortened by the use of a liberal, adequate dietary regime. Hemorrhage or perforation, however, of necessity demand immediate discontinuance of food. The usual feeding schedule in this disease is to administer food at two-hour intervals from morning until midevening, usually eight feedings of roughly 400 to 500 calories each. As convalescence advances, the meals are adjusted to three main meals with three in-between meals, as used frequently in diet therapy.

Tuberculosis

Tuberculosis is a chronic long-continued disease with little or no metabolic increase, according to McCann and Barr, except where temperature elevation occurs. Protein destruction is less intense than in other fevers, and since dynamic action is the same as in normal persons, the protein level should be the same as maintained in health if metabolic increase from dynamic action is to be prevented. Another factor to be kept in mind in tuberculosis is that protein and carbohydrate affect the volume of respiration to a greater extent than does fat. Since lung rest is imperative in pulmonary tuberculosis, modern dietary treatment consists of a moderate protein and carbohydrate level and a high fat intake, a regime much more to be preferred than the old milk-egg-lactose drinks with which the patients were formerly stuffed. Obesity is not an asset, and rapid weight gain does not necessarily indicate clinical improvement. McCann suggests that a diet containing 60 to 90 gm. of protein, 150 gm. of fat, and enough carbohydrate (about 200 gm.) to bring the calorie intake to 2,500 calories, is sufficient for the average patient on bed rest.

In the acute stage of the disease the diet will be liquid, then semiliquid, then the diet of convalescence. Experimental data are accumulating to indicate that the vitamin and mineral intake should be above that required in health. This is especially true of vitamins A and C. For this reason any curtailment in carbohydrate should not be by curtailment of fruits. Five and 10% vegetables in place of 20% vegetables will supply minerals and vitamins with low carbohydrate content. Whole grain, partly milled, wheat germ or vitamin-reinforced cereals and cereal products should be used for their vitamin B complex content.

Inasmuch as tuberculosis is a disease of long duration and curtailed activity, the diet must be adjusted to the patient's economic, environmental, and personal characteristics. Easily digested, palatable, well-planned meals are of prime importance. Lack of appetite is frequently a difficult complication.

Contentment is good medicine here, as in all other disease conditions.

Pneumonia

Pneumonia is an acute infection in which there is disturbance of chloride and nitrogen metabolism with lung involvement. The disease is of short duration. The diet need not be completely adequate, but it should be a palatable liquid diet, given in small amounts at short intervals, necessitating minimum exertion and disturbance. Fifteen hundred to 2,000 calories will be sufficient, even though there may be a metabolic increase to 50% above basal. Fruit juices supply vitamin C, which is thought by some to have more than usual value in promoting resistance to the infection. The necessity for lung rest and factors which affect respiratory exchange apply also to pneumonia.

The distressing abdominal distention, which sometimes occurs in pneumonia, is not of dietary origin, but probably is due to toxic paralysis of the intestine. Increased salt intake is found by some to decrease the symptom. During convalescence the diet is gradually changed from liquid to soft, and then to the typical diet for convalescence.

Other Infectious Diseases

Other infectious diseases, such as scarlet fever and whooping cough, may need dietary management, but inasmuch as the duration is not long, the diet need not be entirely adequate.

In **scarlet fever** there is disturbance in the elimination of nitrogen and retention of sodium chloride, according to DuBois. Therefore, milk and fruit juices are suggested as suitable low-protein foods in the acute stage, after which the usual plan of liquid diet, then soft diet, and on to the convalescent diet and normal protein intake is instituted.

Whooping cough is frequently rather long drawn out, and malnutrition often becomes an unwanted complication. Loss of food in vomiting may be serious. Smaller, more frequent and more concentrated meals of easily digested foods may prove helpful. Deficiencies must be guarded against. If food ingestion cannot be made adequate, commercial vitamin products and various means of padding may be employed.

In other febrile conditions the affected part and the patient's comfort serve as guides to necessary adjustments in the diet.

Nursing care and special attention in the care of the mouth, which should be cleaned before and after feedings, will go far in encouraging the patient to eat adequately.

Review Questions

What dietary adjustments are necessary in fevers of short duration?

What causes hyperthermia?

To what extent does fever affect metabolic rate?

Is the old saying, "Stuff a cold and starve a fever," now tenable?

What attention should be paid to protein in the diet of a fever patient?

For what reasons is the carbohydrate increased?

Is the fat level increased or decreased?

Is water intake of importance?

Should the diet be acid or alkaline in reaction?

Why is the salt intake important?

What type of diet should be served in fevers?

What specific dietary measures are required in typhoid fever?

How does the diet for tuberculosis differ from the normal diet?

What type of diet is advised in the acute stage of pneumonia? Scarlet fever?

What complications may ensue in whooping cough which affect the dietary regime?

CHAPTER XXXII

ADDISON'S DISEASE

The adrenal glands (also called the suparenal bodies) are, in mammals, composed of two parts, the cortex and the medulla. Experimental work on animals is an example of the value of animal studies in the effort to determine the cause, effect, and therapy of disease. Such work indicates that the removal of the gland produces very definite symptoms, and since removal of the medulla alone produces no obvious physiologic change, it is apparent that the symptoms produced are due to the removal of the cortex portion. Dogs in which bilateral adrenalectomy is performed recover rapidly from the operation, but in a few days develop severe symptoms of anorexia, with particular aversion to fatty foods. Then follow vomiting, diarrhea, and sometimes the passage of fatty stools. Muscular weakness of the hind legs, twitchings, and tetanic convulsions soon follow. The metabolic rate is decreased, the body temperature and blood pressure rate fall, and the heartbeat becomes slow and irregular. Urinary secretion is markedly decreased, possibly to the point of anuria. Hallucinations (judging from the irrational actions) and coma appear shortly before death, which occurs, on the average, ten days after removal of the glands.

There is diversity of opinion as to the cause of the symptoms and the mechanism of death—disturbance of kidney function, change in capillary endothelium, alteration in the gastrointestinal tract epithelium, liver or pancreas damage, lack of balance between water and minerals, and other disturbances. No theory explains the condition satisfactorily.

Animal experimentation, such as described, has made evident the fact that this disorder, described first by Addison in 1855 and called by his name, is a clinical condition due to deficiency in function of the cortical portion of the adrenal.

Addison's disease is insidious in onset. Languor, loss of appetite, aversion to fatty foods, muscular weakness, and fatigue are early symptoms, and may for a time be ignored. A peculiar skin pigmentation (due to melanin) may be the first symptom to at-

tract attention. The color may range from bright yellow to true bronze or tan. As the disease progresses, vomiting, diarrhea, and weight loss occur, and are followed by fall in blood pressure and neurologic symptoms. If the condition is not treated, the life expectancy of the individual is from one to one and a half years after it is recognized. Treatment is directed toward re-establishment of the normal blood pattern. Compensation is made for the marked excretion of sodium and chlorine in the urine which results in low blood level. Effort is made to combat the decreased blood volume concentration and the elevated potassium, calcium, and urea levels. To some degree these can be accomplished by careful dietary adjustment. The dietary is unquestionably hard to follow. Intake of sodium chloride (as such) is increased to 10-20 gm. daily, and potassium, to which the victims seem sensitive, is curtailed to about 2 gm. daily. This has resulted in clinical improvement but still has left much to be desired.

In Addison's disease potassium piles up in the system because the body cannot excrete it. It is, therefore, necessary to reduce the intake of potassium in the food from the normal 4 gm. daily to about half that amount. This can be accomplished by the omission of dried fruits and vegetables, concentrated sauces, condiments, unmilled cereals, meat gravies and soups, and by limiting the intake of meat. If meats and vegetables are cut into small pieces and soaked in cold water, then cooked with a large volume of fresh water, part of the potassium can be removed. Unfortunately such procedure removes flavor as well as minerals and water-soluble vitamins. Liberal salting will make such foods more palatable and raise the total sodium chloride level of the diet.

In addition, administration of large amounts of sodium, as sodium chloride, sodium bicarbonate, and sodium citrate, is of value. Common table salt, NaCl, is given as medication in amounts between 10 and 20 gm. in the form of 1 gm. tablet every hour with water. It may be taken in fruit juices or as a salt solution.

The tables of potassium and sodium chloride content of foods of value in planning the dietary of the patient with Addison's disease are listed in the Appendix, Tables 106 and 107.

The diet of these patients may follow the schematic outline for the normal diet, with special emphasis on liberal intake of protein and carbohydrate, moderate use of foods of high calcium content, curtailment of potassium, liberal use of foods high in sodium

chloride, and generous intake of water. The diet must be adequate calorically to correct weight loss or to maintain weight. Fat is a logical means of increasing calories if a distaste for fat does not ensue. Carbohydrate may be increased by the use of candy, sweetened drinks, and other means.

The curtailment of whole grain cereals, the discarding of the cooking water of vegetables, the restriction of certain vegetables and fruits, and the limitation on milk intake results in a dietary low in vitamin B complex. Supplementation by commercial vitamin B, and probably also by ascorbic acid (vitamin C) is, therefore, necessary. Experimentation is reported that suggests beneficial results from generously increased amounts of vitamin C. The normal adrenal gland contains a high percentage of ascorbic acid.

When a synthetic cortical hormone is being administered, there is little need to continue a diet low in potassium. Great care must be taken, however, to continue a diet high in readily available carbohydrate. Hypoglycemia may become a serious complication.

Future developments in therapy for this condition are awaited with keen interest. Fortunately, Addison's disease is not common. It occurs in the third to fifth decades of life, and most commonly in males.

Review Questions

What is Addison's disease?

What are the early symptoms?

What symptoms follow?

What changes in the blood pattern occur in this disease?

To what end is the treatment directed?

What adjustments from the normal are made in the dietary of these patients?

Are any vitamin supplements necessary?

What other treatment for this disease has been developed in recent years?

Is the disease more prevalent among women or men? At what time of life?

CHAPTER XXXIII

GASTROINTESTINAL TRACT DISEASES

The Mouth and Stomach

Most diseases which affect the gastrointestinal tract are the end result of errors in diet, disturbed motility and tone, or abnormalities in the secretory processes. Heredity, poverty, neurologic or specific disease conditions may be associated causes. The reader is referred to Chapter VII, Digestion, where the mechanics and hygiene of the gastrointestinal tract are discussed. Obviously, any abnormality in the digestive juices, in composition or amount, or alteration in the motility and tone will interfere with normal digestion and absorption of food.

The Mouth.—In the mouth, if the teeth are intact, food is broken into fine particles mechanically and is mixed with saliva. Anything which interferes with these functions obstructs the first step in the digestive process, and if for any reason the chewing of the food cannot be performed, a diet must be adopted that is of such consistency as to obviate the need for chewing. Carcinoma, mouth injury, or inflammatory conditions of the mouth tissues, call for liquid diet. In ulceration, inflammation, or obstruction of the esophagus a liquid diet may be used, or the condition may require feeding by gavage (see Chapter XXVII). In inflammation of the esophagus the diet must be bland as well as liquid, and in acute cases the condition may require gastrostomy (establishment of a gastric fistula) to prevent malnutrition or starvation. Cardiospasm (failure of the esophagus-stomach sphincter to relax normally in the swallowing reflex) will call for a bland, liquid diet which is neither excessively hot nor cold, as the excessive temperatures have a tendency to interfere with normal reflex action.

The Stomach.—Abnormalities of the stomach include alteration of tone in which the stomach muscles fail to contract normally and food is retained in the stomach beyond the normal time. Smaller and more frequent feedings, the use of a concentrated liquid diet, or a smooth diet low in fat and low in total liquid may be used in this condition. This may be the soft diet used in

convalescence, and if it is low in fat it will not delay the normal emptying time of the stomach as a diet higher in fat would tend to do. Frequently with improvement in general health there is return to normal tonicity and an adequate diet is important as a means to this end.

If hydrochloric acid is present in the gastric juice above the normal level of 0.2 to 0.4%, hyperacidity (also spoken of as hyperchlorhydria and gastroxia) will result. This condition, not a disease entity in itself, is frequently secondary to other pathologic conditions and predisposes to the distressing gas, acid eructations, "heartburn," etc., sometimes encountered. Nearly all patients with gastric ulcer and many high strung, nervous individuals show this increased stomach acidity. The acid is irritating to the tender mucous membranes of the stomach and, if unchecked, results in inflammation of the lining tissue. The degree of stomach acidity can be readily determined by gastric analysis. Treatment consists in decreasing or neutralizing the acidity. A low residue diet is used as pressure tends further to stimulate the acid-producing cells. Stimulating foods are eliminated, and the diet must be bland, but not tasteless—as frequently results by too low a level of seasoning in the zeal to eliminate stimulating ingredients (see Chapter XIV, Food Adjuncts). The protein level should be high, since in the process of digestion the protein ties up with the gastric hydrochloric acid and reduces the amount left free. Milk, cheese, gelatin, and eggs are preferable to meat because the extractive content of meat has a stimulating effect. Fat tends to depress the secretion of gastric juice, and hence decreases the outpouring of the acid. Concentrated foods, such as sweets, extremely hot or extremely cold foods which are stimulating, pastries, fried foods, and hot breads which are difficult to digest, and alcohol are contraindicated. Coffee and tea in moderation are permitted. Treatment also includes a search for the probable contributory cause and its alleviation which in turn will relieve the stomach acidity.

The reverse condition known as hypoacidity, hypochlorhydria, and achlorhydria (absence of hydrochloric acid in the stomach) likewise occurs, and is related to a number of such clinical conditions as Addison's disease, chronic alcoholism, and myxedema. Bulk in the diet is reduced to a minimum, and easily digested nonirritating foods are included to decrease to a minimum the work of the stomach. Fat is reduced to a low level because of its depress-

ing effect. Meat juices and fruit juices, which tend to stimulate gastric juice flow, are used. In this condition other gastric enzymes may be deficient or absent (achylia gastrica). It is then essential that foods which will leave the stomach quickly be given, so that fermentation cannot take place. Here it must be remembered that attractive, savory, palatable food is conducive to a copious flow of gastric juice, and that the act of chewing also sets up preparatory changes in the gastrointestinal tract. Crisp toast or crisp bacon or other foods which require chewing, but which leave no residue, are of value in initiating peristaltic waves.

Gastritis, acute or chronic, is an inflammation of the mucous membrane of the stomach. By use of a gastroscope the stomach lining is seen to have undergone changes like those seen in other inflamed mucous membranes. This condition was once recognized clinically, then its existence was denied, and only recently has it been reaffirmed. The cause is not clearly defined, but it may be dietary, due to excessive alcohol or drugs, or indirectly to a disease condition elsewhere, such as pulmonary tuberculosis, syphilis, cirrhosis of the liver, nephritis, myocardial failure, and polyarthritis. Dietary treatment is based on the same rules which govern any dietary treatment—recognition of the abnormality and adjustment of the diet to it, with precaution against development of a deficiency. Smooth bland diet, or one suitable in convalescence is indicated. Further adjustment may be necessary if either hypoacidity or hyperacidity exists.

Ulcers, gastric and duodenal, receive the same dietary treatment. In the United States about ten times as many ulcers are duodenal as are gastric. Hyperacidity occurs in the majority of cases. As a rule, regardless of whether the ulcer is stomach or duodenal, it is located near the pylorus, and healing of a break in the mucous membrane is difficult because of the ever-present peristalsis and contraction and relaxation of muscles. The affected region is not only in constant motion but is constantly bathed by digestive juices and partially digested food. Even if the last factor could be eliminated, the other two would still remain. For this reason, fast periods and the use of duodenal tubes designed to pour the food directly into the intestine below the point of trouble are less satisfactory than might be expected. The problem is to provide an entirely adequate dietary which will not irri-

tate or stimulate the affected part. Roughage, spice, alcohol, or extremely hot or cold drinks must be eliminated. Protein foods, especially milk and egg, will combine with the free hydrochloric acid in the stomach and reduce the acidity without producing a stimulating effect ordinarily gained from meat. Fat has a depressing effect on hydrochloric acid. These give the basis for the ulcer diet, the milk-cream diet so well known as the Sippy diet (sometimes spelled Sippi). This diet consists of equal parts (45 gm.) of milk and cream every hour for one week, then the gradual addition of cereal, cream soup, custard, or junket at two of the feedings the second week. During the third week further additions are made, and so on.

There are a number of diets for use in ulcer. Einhorn feeds a formula of 240 c.c. of milk, 1 raw egg, and 15 gm. of lactose every two hours for 8 feedings by duodenal tube. Lenhartz uses milk-egg mixture every hour for five days, then gradually adds scraped beef, boiled rice, toast, etc. Coleman advocates a diet of glucose, olive oil, egg white, salt, and water. Seale Harris uses a diet similar to the Sippy, but includes orange juice at regular intervals with the milk and cream mixture. The addition of orange juice supplies the vitamin C so essential for the healing process.

A modification of the Sippy diet is the method most generally used. As a rule, the patient should stay in bed for three to four weeks. Feeding is begun immediately without any preliminary starvation period. The plan Sippy found most adaptable is given in Table 89.

While the Sippy form of treatment is excellent medical procedure, it must be individualized the same as any other diet to meet the needs and pleasure of the patient. One disadvantage of this diet is the marked deficiency of ascorbic acid—a vitamin so essential for tissue healing. It is also low in thiamine, riboflavin, niacin, and iron. In addition, it requires sodium chloride if mineral balance is to be maintained under calcium carbonate therapy. When the Sippy diet is used, vitamin-mineral supplementation should accompany it. By the end of three to six weeks on the Sippy regime, depending upon the severity of the condition, the patient has had his diet increased from the liquid diet to the soft diet, is permitted to resume work, and takes his food as three main meals a day with between meal feedings. He should continue to avoid such foods as raw fruit (except juices) and raw vegetables,

nuts, spiced or highly seasoned foods, fried, rich, and excessively sweet foods, or those difficult to digest, and alcohol. In other words, he continues to adhere to a diet suitable for convalescence. This is a normal diet with minor restrictions, and he will remain on it indefinitely if he is wise. Recurrences of ulcers are not infrequent in individuals who considered themselves cured and had resumed the completely normal diet. Prevention of recurrence should also include mental peace, as far as it can be attained, adequate rest, and avoidance of violent exercise. Fatigue, emotional upset, and infection are causes of the frequent recurrence of ulcers. Incessant care and adherence to the necessary rules of health are important for all ulcer patients.

Table 89

Three ounces of a mixture of equal parts milk and cream are given every hour from 7 A.M. until 7 P.M. After two or three days soft eggs and well-cooked cereals are gradually added, until at the end of about ten days the patient is receiving approximately the following nourishment: 3 ounces of the milk and cream mixture every hour from 7 A.M. until 7 P.M., and in addition, three soft eggs, one at a time, and 9 ounces of a cereal, 3 ounces at one feeding, may be given each day. The cereal is measured after it is prepared.

Cream soups of various kinds, vegetable purées, and other soft foods, may be substituted now and then, as desired. The total bulk at any one feeding while food is taken every hour should not exceed 6 ounces. Many of the feedings will not equal that quantity. The patient should be weighed. If desired, a sufficient quantity of food may be given to cause a gain of two or three pounds each week.

A large variety of soft and palatable foods may be used, such as jellies, marmalades, custards, creams, etc. The basis of the diet, however, should be milk, cream, eggs, cereals, and vegetable purées. Lean meat is not given during the period of accurate observation, since it interferes with the tests for occult blood in the stool and aspirated stomach contents.

Alvarez states that while the Sippy diet brings good results, it is too elaborate for general use and requires more than meager intelligence or ordinary nursing care to follow it. He has devised an ambulant form of treatment which can be followed by the patient who is up and about. It is particularly adaptable to the patient with duodenal ulcers which are less prone to become malignant than are gastric ulcers. Alvarez permits his patients to remain at work and to have three meals a day, the smooth, nonirritating meals essential in any gastrointestinal lesion. Between meals the patient

receives a feeding of the following mixture: 1 quart of milk, 2 eggs, ½ pint of cream. This may in part be taken to work for a midmorning and midafternoon meal, and the remainder may be consumed in the two evening snacks, or one in the night if the patient awakens. If the mixture is not available at the correct time, Alvarez advises a milk shake or malted milk at a soda fountain, or a dozen malted milk tablets. The patient must do no heavy work, such as lifting or gardening, neither must he enter into any recreational activities other than walking. Supplementation of the diet by commercial vitamin products is usually desirable, and experience has shown that a vitamin intake well above normal (approximately double) is advisable. Because fruits and vegetables are drastically curtailed in this diet, there is danger of deficiencies of the vitamin B complex, vitamin C, and possibly vitamin K.

The type of "alkaline powders" and the method of their use varies considerably with physicians, and will not be described here. Belladonna in some form is also frequently used.

If hemorrhage occurs, rest is imperative, physical, mental, and alimentary. Sedatives will probably be necessary. Just how long food must be withheld is a question. Some authorities believe that nothing should be given by mouth until all bleeding stops, and others contend that frequent feedings neutralize the gastric juice and prevent the juice from digesting the forming blood clot. Others would use a neutralizing drip (by means of a Levine tube) to prevent clot digestion and withhold food which might dislodge the clot.

The type of treatment will vary with severity of the condition, its source, the age and general health of the patient. Surgery may need to be employed.

Cancer in the gastrointestinal tract requires the same treatment as any other type of lesion, although as time passes and the condition becomes progressively worse, the liquid type of diet rather than increased food intake will probably become the order. Diet intake for the greatest comfort of the patient should be the rule. Smaller meals at more frequent intervals is usually the preferred course. The regime will be governed by location of the lesion, stage of advancement, whether surgical intervention is practical, and the nature of the functional disturbance and secretory disorder. Varying degrees of obstruction may exist, diminu-

tion of motor activity, hyperacidity or hypoacidity. Anorexia is frequently present; therefore, palatability, variety, padding, and attractiveness in service play an important part. Unless contraindicated, the personal likes and dislikes of the patient should be given every attention.

Pylorospasm. Just as spasm may occur at the cardiac end of the stomach, it may occur at the pyloric end, and prevent normal passage of stomach contents into the intestine, with resulting stagnation, gas formation, and distention due to dilatation of the stomach (gastrectasis). A stenosis or constriction of the pylorus from any cause will bring about this same result. Surgical intervention is usually necessary, and small, frequent feedings of nonstimulating, nonirritating soft foods, accompanied by daily lavage (washing) of the stomach, give relief and are the practice often necessary in preparing a patient for surgery.

Mucous colitis is regarded as a disorder primarily of the nervous system, which manifests itself in the intestinal tract due to instability of neuromuscular control. The term mucous colitis is used because large quantities of mucus are passed in the stools. Constipation is usually present. The diet suggested in this disorder is a well-balanced, smooth, nonirritating diet, which derives its bulk from smooth roughage (see Bulk in Relation to Health), rather than from the use of large quantities of vegetables and cereals. Agar likewise provides a smooth bulk. The diet should consist of milk, cream, eggs, tender meats, fruit juices, puréed vegetables, and either white or wheat germ or vitamin B reinforced bread which is devoid of all bran (see Cereals, Chapter VI). The vitamin intake must be adequate, and the vitamin B complex intake must receive special attention because of the curtailment of whole grain cereals. A commercial source of the B complex will be of value, for instance, Vegex, a yeast preparation, which fits easily into the dietary as a food product.

Ulcerative colitis, another and serious form of this disease, affects the large intestine. Its cause is unknown. It may be an infection, an allergic manifestation, or a nutritional deficiency. These theories all have support. The disease naturally is intensified by emotional upsets, inasmuch as an intimate relationship exists between emotional disorders and digestive functions. The mucosa is first edematous and diffusely hyperemic (excessive

amount of blood); it bleeds readily. Later, small abscesses form, rupture and bleed. The entire colon may be involved. The symptoms appear insidiously, with periods of remission and activity. Diarrhea and constipation accompany the disorder, and once it is established, it tends to become chronic.

The treatment entails prolonged bed rest, a smooth diet high in protein (150 gm.), high in vitamins (double or triple normal intake), high in minerals, and otherwise adequate. Malnutrition and anorexia are usually encountered. Occasionally sensitivity to certain foods develops, unfortunately often to milk, eggs, oranges, tomato, and wheat. If milk is well tolerated, the basic diet may well include two quarts daily. Padding with powdered milk may be used if the two quart bulk is too great. To compensate for the increase in protein, fats should be curtailed. Commercial vitamins are employed. Hypovitaminosis, due to faulty absorption, has been suggested as a cause for continuance of the disease. Liver extract has been shown to have distinct value in some cases.

During acute stages of the disease, the diet must be limited to liquids. It then progresses, according to the condition of the patient, through the soft diet to the diet for convalescence, and in this form it is continued for life. Trial and error with intelligent watchfulness on the part of the patient, in cooperation with the physician, and ruling out of possible allergies, is the wise method of adjusting the diet. Individual tolerances vary from time to time, and individuals differ in regard to the foods which may be gas-forming. Tolerances for fats and starches vary with the individual also.

In reviewing the disorders of the gastrointestinal tract so far discussed, it is seen that in general the principles for preparing the liquid and soft diets, and diet for convalescence, cover all the adjustments needed (see Chapter XXVII on the feeding of invalids). It is a matter of providing an adequate, well-balanced diet of such consistency and composition that it will be nonirritating, low in residue, devoid of high seasonings, and lacking in foods which are rich, gas-forming, or hard to digest. The need for vitamins to maintain epithelial integrity is now recognized in combating lesions of the gastrointestinal tract and in the planning of these diets. This fact must be kept closely in mind.

Wilbur, in discussing the role of the gastrointestinal tract in conditioning deficiency diseases, remainds his readers that the

gastrointestinal tract plays an essential role in obtaining and utilizing nutritive substances. Not only the intake but the state of function of the gastrointestinal tract must be considered. There may be diminution or loss of digestive secretions, inadequate absorption of the food nutrients, loss through vomiting, an external fistula or diarrhea, or alterations in metabolism requiring increased needs.

In the treatment of any gastrointestinal disorder, these factors must be borne in mind and treatment adjusted accordingly. Frequently, dietary means are not wholly adequate and commercial products must be used as supplements.

Except where specifically indicated otherwise, from the standpoint of ease of preparation, economy, palatability, and the patient's enjoyment, it is preferable to prepare these diets by modification of the family dietary. If the suggestions given above and in Chapter XXVII are followed, this can readily be done. Specific diet menus are generally unnecessary and should be avoided whenever possible. A further advantage is that the adjusted diet, by conforming to the normal diet pattern, is less liable to deficiencies.

In order to ascertain the **specific** character of a gastrointestinal disturbance, various **procedures** are used. The test meal (Ewald) is composed of 250 c.c. of water or weak tea and $1\frac{1}{2}$ ounces of dry toast, taken in the morning on an empty stomach. Samples of gastric contents are withdrawn at intervals to determine the extent of digestion and the efficiency of the digestive juices. Material may also be withdrawn from the duodenum by use of the duodenal tube. The speed with which food leaves the stomach may be determined by adding to an ordinary meal characteristic substances, such as berries with seeds or tea leaves. Withdrawal of contents at intervals indicates the speed of evacuation.

The time between ingestion and final elimination of food is determined by the ingestion of a "marker," such as carmine, glass beads, or charcoal, and watching for its appearance in the stool.

Bismuth or barium may be added to a milk drink, and its passage may be followed the entire length of the tract by the fluoroscope and x-ray.

Gastroscopes are employed for looking directly into the stomach, the proctoscope for inspecting the rectum, and the sigmoidoscope for examining the sigmoid flexure.

Besides these methods, gross, microscopic, and chemical analyses of the feces will determine their normalcy and frequently influence treatment.

Review Questions

What general modification of diet is advised in abnormal conditions of the gastrointestinal tract?

When the tonicity of the stomach muscles is weak, what type of diet may be necessary temporarily?

What are the outstanding characteristics of the diet used to combat hyperacidity of the stomach?

What food adjustments are necessary in cases of hypoacidity of the stomach?

What diet is indicated for acute or chronic gastritis?

What is the diet most generally used for patients with gastric or duodenal ulcers?

What other diets are sometimes prescribed?

Is vitamin supplementation advised in treating gastrointestinal lesions?

What advantages accrue from adjusting the family dietary to a member with a gastrointestinal difficulty?

What means may be employed to determine the specific character of a gastrointestinal disturbance?

CHAPTER XXXIV

DISEASES OF THE LIVER AND GALL BLADDER

The Liver. Diseases of the liver are considered under disorders of the gastrointestinal tract, inasmuch as the liver plays such an important role in the digestion and utilization of food. The liver is essential for normal protein metabolism. It stores, resynthesizes into body protein, and breaks down the amino acids for combustion and deamination. It is the storehouse for carbohydrates. The liver glycogen serves as a source of dextrose to maintain the blood level constant. The role of the liver in fat metabolism is several sided. It is a storage place for fat and is concerned with the metabolism of fat-soluble vitamins A and K. It is further concerned in the normal utilization of fats in that the gall bladder, attached to the liver, acts as a reservoir and stores the bile which the liver has manufactured, and pours it into the intestinal tract where its work takes place. As indicated in Chapter VII, bile is necessary for normal fat absorption. The liver also acts as a detoxifying agent when toxic substances are brought into the body in food, are produced by bacterial action, or result from parasitic infections. It also converts worn-out red blood cells into bile pigments. If liver cells become sluggish from continued abuse, from faulty dietary regime, or are injured, various abnormalities result and are followed by disturbances in digestive and metabolic functions.

The diet in liver or hepatic disease necessarily takes account of these conditions. If the liver is well stocked with carbohydrate, it is much more resistant to experimentally produced injuries, and its cells can more rapidly be restored to normal function than those of a liver whose carbohydrate (and therefore glycogen) content is low. Hepatic injury brings about a lower than normal storage of carbohydrate and hence disposes it to further injury. See discussion of liver function in Chapter VII.

Recent experimental work indicates that, contrary to former views, the protein content of the diet in liver disorders should be kept relatively high (70 to 100 gm.), rather than at merely maintenance level. The protein apparently has a protective value in addition to its function of promoting tissue repair. Moreover, relatively high protein is of value in combating tendencies to change in

serum proteins and hypoproteinemia which may occur in serious liver disease. However, too great an excess of protein entails undesirable additional hepatic activity and must be guarded against.

Milk and eggs should supply the major part of the protein intake in liver disorders. The fat level should be decreased. A moderate amount of easily digested fat, such as egg yolk, cream, and butter, is allowed. These add calories, are carriers of fat-soluble vitamins and essential fatty acids, and prevent too much bulk in the diet. The amount of fat used is usually the difference in calories between the sum of the protein and carbohydrate calories and the desired total calories. It must be kept in mind, however, that when the liver does not function normally, fat absorption is incomplete. When oral intake of food is low, intravenous glucose may be employed with good results.

The vitamin intake is important because of the role of the liver in the storage and utilization of vitamins, and because interference in bile secretion will decrease the absorption of the fat-soluble group. The use of commercial concentrates of vitamins is, therefore, usually wise. Recent experimental studies indicate that vitamin C has a protective action against liver damage. High vitamin C intake at least is worth consideration.

Liver extracts are beneficial and McLester believes they should always be given a trial.

Anorexia is a complicating symptom and requires psychic and gustatory incentives to overcome it. Three meals a day, two between meals, and a bedtime lunch increase the potential intake with least discomfort. A glass of hot water with the juice of half a lemon a half hour before breakfast is often helpful. The diet should contain no irritating foods, condiments, or alcohol.

To summarize, the diet in liver disease should be high in carbohydrate, have a protein level of a gram to a gram and a half per kilogram of body weight, and a low fat level. It should have variety, should not contain excessive bulk, and should include a liberal intake of vitamins. It is designed to prevent overwork of the liver cells, to provide optimum protection against further injury, and to promote recovery. The diets outlined in Chapter XXVII will provide suggestions. Under varying conditions the diet may be liquid, soft, or adjusted to convalescence. The adjustment in the last type would be the elimination of meats, especially

the glandular meats, meat broths, and meat juices, because these require great liver cell activity for their utilization.

Cirrhosis, or hardening of the liver, is only slightly amenable to diet treatment. This disorder brings hypoproteinemia (low blood protein level) which is conducive to ascites (edema). Liberal protein should, therefore, be included in the diet. The response of nutritional edema to vitamin B_1 led to its trial in the liver edema with apparent success. Liver extracts are of value. The diet must be adequate. If only normal amounts of food are eaten with difficulty, commercial vitamins should be administered, especially vitamin K, to combat the hemorrhage which frequently occurs in cirrhosis due to lack of this vitamin. Lack of vitamin K may be due to failure of absorption, to a destructive action within the liver itself, or to a decrease of normally functioning liver cells. Bile salts must be administered with the vitamin K unless the product is one of the new water-soluble synthetic products having a vitamin K-like activity. Choline, cystine, and methionine are being tried currently in the treatment of fatty and cirrhotic livers. The data are inconclusive.

The **gall bladder** correlates the secretory activity of the liver with the activity of the gastrointestinal tract. It stores the bile elaborated by liver cells, and releases it to the intestine by hormonal or psychic stimulus. Cholelithiasis (stone formation) or cholecystitis (inflammation) may interfere with the normal function of gall bladder, and one disorder seems to bring about the other, although which is the cause and which the effect is questionable. The predisposing causes are biliary stasis, with stagnation of the bile, increase in concentration, and deposition of insoluble matter. Infection may involve the gall bladder and the bile. Infections of the teeth, tonsils, or appendix may act as foci. Cholecystitis may be a complication of typhoid fever, and residual biliary tract infection is thought to be responsible for many of the typhoid carriers. Infection may arise from the intestine itself (colon bacillus). There may be disturbance in bile pigment excretion, and small pigment-calcium stones are formed in certain cases of jaundice. Upset of the normal cholesterol metabolism may result in the formation of gallstones, waxy and glistening, varying in size from a grain of sand to a small hen's egg, and from one to several hundred in number (94% of all gallstones contain cholesterol). Stone formation may take place at any age, but it occurs

most frequently in women between 30 and 50 years, particularly in the "fair, fat, and forty." Obesity seems to bring a disturbance in cholesterol metabolism. Rapid weight reduction or starvation, with mobilization of fat, results in hypercholesteremia. In pregnancy disturbances of cholesterol metabolism also occur.

The attack of gallstones or inflammation of the gall bladder is much like "indigestion" with loss of appetite, gas, sour taste in the mouth, nausea, constipation or diarrhea, sharp pain, fever and chills. Intolerance for fat may be present.

The dietary treatment is based on three factors: association between hypercholesteremia and gallstone (biliary calculi) formation, normal stimulating action of fat upon the emptying time of the gall bladder, and the frequent coexistence of hepatitis. These conflicting factors lead to complication in diet planning, and malnutrition may be a further element of confusion. Diets low in fat, low in cholesterol, and either high or low in calories may be used, or diets relatively high in fat and cholesterol with caloric adjustment may be preferred. In any case the protein is relatively high, 80 to 125 gm., since protein as well as fat has a stimulating effect on gall bladder evacuation. Carbohydrate will supply the remainder of the calories which must be low enough to avoid weight gain, since obesity and overeating are undesirable. When blood cholesterol is high, foods rich in cholesterol (eggs, butter, cream, and glandular meats) should be excluded (see table of Cholesterol-containing foods in the Appendix). As Twiss and Greene point out, the cholesterol values available leave much to be desired. There is need for greater accuracy in distinguishing between the types of sterols present in foods. However, this is the best list available at present.

When the gall bladder is sluggish and neither fat intolerance, hypercholesteremia, nor stones exist, a high fat-cholesterol intake is of value. These substances stimulate the formation of cholecystokinin, a hormone which Ivy and his co-workers have shown to produce gall bladder contractions. Therefore, the diet should contain a generous amount of protein and should be high or low in fat, depending upon the type of gall bladder dysfunction. The diet should be adjusted calorically to the nutritional need with carbohydrate. The vitamin intake may need supplementation, depending upon fat intake and absorption, and the amount of liver in-

volvement. Minerals should be adequate. The diet should be nonirritating and should contain only easily digested foods. The bulk should be adjusted to the condition of the rest of the intestinal tract. A "lazy" colon is frequently associated with gall bladder diseases (see Constipation, Chapter XXXVI). Smaller and more frequent meals are preferred when cholecystitis and other gastrointestinal disturbances exist. Hypoacidity or hyperacidity may require consideration.

Jaundice, with greenish-yellow discoloration of the skin, comes from partial or complete exclusion of bile from the intestinal tract, and usually results from an inflammatory condition of the biliary tract. It may also result from toxic destruction of liver cells by certain poisonings, chloroform, yellow fever, phosphorus poisoning, etc. A third type of jaundice occurs, hemolytic jaundice, from destruction of red blood cells and breakdown of their hemoglobin into bilirubin, a bile pigment. Jaundice means yellow, and in this disease the bile pigments stain both the eyeballs and the skin.

Diet in jaundice should be a simple, nonstimulating, smooth diet, consisting chiefly of milk, cereals, toast, and potato, for the first ten days. After that time tender meat, eggs, cooked fruit and simple desserts—custards, gelatin, rice, etc., may be added as clinical conditions permit.

Review Questions

What important functions does the liver perform in the digestion and utilization of food?

Approximately how much protein per kilogram of body weight should a diet in liver disease contain?

Should the carbohydrate be high or low?

Should the fat level be high or low?

What other factors should be considered in planning a diet for a patient with liver disease?

Why is a liberal intake of vitamins advisable?

What specific vitamins are valuable?

What is the function of the gall bladder?

What difficulties may interfere with its normal functioning?

What are the symptoms of inflammation of the gall bladder?

What types of diet may be helpful in treating a patient with gall bladder difficulties?

What foods may be served to a patient with jaundice?

CHAPTER XXXV

CELIAC DISEASE

Several hundred articles have appeared in the literature on the subject of celiac disease, but as yet its etiology is unknown. Certain authors contend that tropical sprue, nontropical sprue, and celiac disease are identical; others are sure that differences between these conditions exist. Further, debate surrounds the question whether the condition is due to faulty carbohydrate or faulty fat metabolism, whether it is an avitaminosis or an endocrine disturbance.

Treatment, of course, depends largely upon the causative factor or factors which the physician considers dominant. In spite of the uncertainty, the gradual tendency has been toward the generally accepted type of diet outlined later in the chapter. Whatever may be the cause of the disease, this type of diet has proved to be clinically effective.

The disease "sprow" was first described by Ketelaer in 1669. He commented upon the feces "so copious that several basins or pots scarcely held these accumulations." The disease later became known as tropical sprue because it was believed to occur only in the tropics. Throughout medical writings descriptions occur. The classical description was given in 1888 by Samuel Gee who wrote "On the Coeliac Affection." Later in 1908 Herter published a monograph "On Infantilism from Chronic Intestinal Infection." More Recently, Howland, Haas, Fanconi, Parsons, and Thaysen have added materially to our literature on the subject.

The disease is known by a number of titles, intestinal infantilism, Gee's disease, Heubner-Herter disease, Gee-Herter disease, etc.

Among the principal **symptoms**, present completely or in various combinations, is steatorrhea (fatty stools) either with or without diarrhea. The stools are large, frothy, foul-smelling, with a greasy "oatmeal" appearance. Large numbers may be passed in a day. Gastrointestinal disturbances, such as abdominal colic and gas are frequent. The stomach is greatly distended, the buttocks are shrunken and pendulous. The fat stores are completely used up, and there is extreme muscular atrophy. Growth is stunted, weight is lost, at times wasting may be marked.

The child is introspective, hysterical, and unhappy, a source of misery to himself and to all those around him. In his diarrheal periods the irritability may become extreme. Anemia and symptoms of avitaminosis appear.

With the fatty stools there is upset in the calcium balance. Calcium is excreted in the feces as calcium soap, and there is increased urinary excretion of phosphorus. These combine to bring about abnormal brittleness of the bones due to calcium and phosphorus depletion. Calcium loss has been reported to be so severe as to result in tetany. There seem to be delayed motility and alterations in the small intestine mucosa, especially in the jejunum, possibly with edema.

Fig. 83.—These two children are the same age. The obvious difference between the normal (left) child and the celiac child is characteristic of the disease. (Courtesy of Dr. Curt Falkenheim.)

These symptoms have led to several theories: first, that celiac disease is a specific, and perhaps infectious, disease of the small intestine which results in multiple nutritional deficiencies; second, that it is due to pancreatic or biliary insufficiency; and third, that it is a deficiency disease similar to pernicious anemia. The last theory has led to the use of liver extracts, folic acid, and

vitamin B_{12} (see Anemias, Chapter XL) with some encouraging results. Another suggestion is that celiac disease is a pituitary dysfunction, a failure on the part of the anterior lobe to produce sufficient prolactin (one of the hormones) to enable the gastrointestinal tract to function normally. Recently two more suggestions have appeared, one that an association exists between the celiac syndrome and gastrointestinal allergy, and the other that the intestinal mucosa fails to absorb fats and carbohydrates in a normal fashion. No proof has yet been found for any of the theories.

Gee in his original discussion first suggested that "To regulate the food is the main part of treatment. . . . If a patient can be cured at all it must be by means of diet." Today treatment is based on the same idea.

The **dietary treatment** consists in recognizing the metabolic inability to utilize starch and fats normally. Definite alteration in the ability to absorb these foods occurs. Some place the major emphasis upon the inability to digest and absorb the starches, and others contend that the principal difficulty is with the fat metabolism. Whichever abnormality predominates, it is an established fact that both constituents must be adjusted. The normal relationship of protein, fat, and carbohydrate must be changed. Protein is well tolerated; therefore, in the acute stage proteins exclusively are recommended by some clinicians—protein milk, calcium caseinate milk, cottage cheese, meats, egg white, gelatin, etc. Fruits are added next, especially banana, banana powder, apple, apple powder, orange, then the 5 and 10% vegetables; next a limited amount of flaked or puffed cereal, or thinly sliced toasted bread. The discovery by Haas of the efficaciousness of banana has been a great boon. The carbohydrate of the completely ripe (brown spotted) banana is very well tolerated, and from several to a dozen bananas may be ingested each day. *It is imperative that the bananas be ripe!*

The last addition to the diet is the daily inclusion of an egg yolk. It is true that egg yolk is a source of fat, but the fat content is less objectionable than the loss of its valuable constituents of the yolk—vitamins A and D, phosphorus, essential fatty acids, and lecithin. The choline which lecithin yields has recently been recognized as

a dietary essential. When the diet has reached this point in variety, it is as it should remain until some better treatment becomes known.

The greatest difficulty is to include sufficient calories to insure weight maintenance and growth. When fats are almost entirely omitted, and the carbohydrate is limited to fruit sugars, 5 and 10% vegetables, or small amounts of dextrinized starch, the chief sources of calories are eliminated. Therefore, padding must be resorted to by the use of honey on toast, the addition of powdered skim milk to liquid milk, generous use of bananas, malted milk, the addition of gelatin to fruit juices, and the like.

Liver should be served once or twice a week. It is a source of vitamin A and of the B complex, and is effective in combating anemia from the standpoint of supplying a possible deficiency factor (see Pernicious Anemia, Chapter XL) as well as combating the "secondary" anemia. Liver preparations, administered either by mouth or by injection (Chapter XL), may prove of value.

Commercial sources of the fat-soluble vitamins A and D must be given, and perhaps also vitamins E and K. The diet of the patient with celiac disease will not yield adequate amounts of the fat-soluble vitamins because of the decreased absorptive ability of the intestine. Vitamins and minerals must be above normal because of faulty absorption and symptoms of avitaminosis. Pancreatin may be of value in certain cases.

The diet of the patient must also be low in residue in order not to overstrain the weakened and sagging gastrointestinal tract. To reconcile 5 and 10% vegetables to a low residue diet will require the use of a strainer or the choosing of those vegetables, or such parts of the vegetable, as would entirely or almost entirely pass through a strainer, as the flowerlets of cauliflower, the tips of asparagus, very tender young carrots, etc. In addition, coarse veins must be removed from leafy vegetables, seeds and skin from fruits, and connective tissue from meat in order to adjust the bulk satisfactorily.

The necessary alterations may be made in the diet, and a diet should be planned which could be followed indefinitely, or until some as yet unknown factors are found. Such a daily food list is given in Table 90.

Table 90

	1 qt. skim milk plus powdered skim milk—the amount added should be governed by calories required up to doubling the concentration of the milk—roughly 1 oz. (4 level tbs.) to 8 oz. (1 cup) water results in a "reliquefied" milk
	1 whole egg
Two servings	Meat—beef, chicken, lamb, veal, or pork devoid of visible fat or Fish—light colored (low fat content) only or Liver—calf, beef, pig, lamb, or chicken
	Banana—3 plus, fully ripe (brown spotted) or dried banana products
	Orange—medium size
	Another fruit—apricots, peaches, apples, pears, etc.
	Vegetables—2 servings—tender carrots, asparagus tips, broccoli, small green beans, squash, spinach (strained), cabbage (hard veins removed), tomato juice and vegetable juices, etc.
	Cereal—1 small serving—cornflakes, grapenut flakes and other "flaked" or "puffed" cereals
	Breads—*melba toast* only—not more than 3 *thin* well-toasted slices
	Cottage cheese—skim milk cheese only.
	Puddings as powdered skim milk, Casec, protein milk, gelatin, or honey
	A commercial source of vitamins A and D
	Probably a commercial liver product—some of these (Chapter XLI, The Anemias) contain the vitamin B complex in addition to liver
	If orange must be omitted a commercial source of vitamin C should be given and possibly a commercial source of vitamin K.

The work of May and his associates deserves serious consideration; it gives added emphasis to the value of liver extract and supplementary B complex. These authors indicate that there is a decrease in the emptying time of the stomach, a slowing of the segmenting movements, and dilation of the small intestine, all of which profoundly influence absorption. Injection of crude liver extract and of parenteral B complex, on alternate days, resulted in improvement of the glucose and vitamin A absorption curves and in the motility of the gastrointestinal tract in from 3 to 6 weeks' time. While they find improvement with this treatment, using the routine diet for the age of the patient, it would seem wiser to follow the celiac type of diet until further data are available. However, emphasis on a higher B complex (containing a natural base) and crude liver extract therapy would seem sensible.

Anderson, in her 1947 paper on the "Celiac Syndrome," feels that fat intolerance is transitory and variable—that the inability

to handle starch is the more serious phase. In her studies she finds gastric hypoacidity and low pancreatic amylase. She, too, stresses heavy vitamin therapy but uses the oral route.

Recently, interest has centered around folic acid and vitamin B_{12}, especially in their effect on macrocytic anemia. The results are inconclusive as yet as to its value in celiac disease.

To repeat, the cause is still not clear; however, dietary adjustment, such as that outlined earlier in the chapter, is effective. By following such a diet outline a diet high in proteins, vitamins, and minerals will be assured. The diet will be very low in fat and in starches, the carbohydrate being supplied as simple sugars or dextrinized starches, and it will be low in residue and high in anemia-preventing foods. Such a diet seems to control the disease and clinically restore to health the individual suffering from celiac disease or a steatorrhea.

Review Questions

What are the principal symptoms of celiac disease?

What theories have been advanced as to the cause of the disease?

What food nutrients is the celiac unable to digest and absorb?

What adjustments in diet must be made?

Is protein well tolerated?

What food has been found to be especially efficacious in treating such patients?

What means may be used to furnish sufficient calories in the diet?

How must vitamin content be assured?

Is the disease of short or long duration?

What results may be expected if the diet is rigidly followed?

CHAPTER XXXVI

OTHER DISORDERS OF THE GASTROINTESTINAL TRACT

Certain disturbances are common to the gastrointestinal tract, but are not associated with specific disease entities. Among these are constipation, diarrhea, and flatulence.

Constipation is probably the most common of these disorders, and it causes much needless worry. The idea that to be normal there should be a daily bowel movement has often led to the harmful practice of catharsis. Many individuals remain in perfect health with but one bowel movement every two or three days. Others may have several movements in one day habitually, with no indication of diarrhea. The amount of fecal matter passed daily varies considerably (100 to 200 gm. of moist fecal matter; see Composition of Feces) and is dependent somewhat upon the food ingested.

The idea has prevailed that when fecal matter remained in the body for several days, poisons were absorbed from it and caused the feeling of discomfort experienced in constipation. Alvarez points out that if absorption of poisons (auto-intoxication) were the cause of this discomfort, the symptoms would not disappear immediately upon defecation, as they always do, any more than one could "sober a drunken man by taking the bottle from his hip pocket"—a rather homely but well-pointed statement. The discomfort in constipation is probably of nervous origin from pressure on the mucous membrane, on the pelvic nerves, and perhaps slowing up or halting of normal peristalsis.

McLester outlines the causes of constipation according to the classification of Spencer as (1) dietary faults, deficient residue, or deficient liquid intake. (2) Interference with normal defecation reflex by lack of response, or from injury to the nervous system, as in tabes dorsalis; or when defecation is painful, as in fissures or hemorrhoids. (3) The habitual use of laxatives and cathartics which frequently defeat their purpose by bringing on intestinal spasm from their irritating and inflaming qualities. If the purge is too drastic, the entire large intestine is emptied, and no material remains for evacuation the following day. Normally a cer-

tain amount of fecal material remains in the ascending colon, and usually in the transverse colon, after each evacuation. (4) Lack of exercise, which leads to weakness of skeletal muscles and lowering of tone. Any change in neuromuscular control of the bowel may lead to constipation. (5) Stasis which from any cause allows time for extraction of abnormal amounts of water from the fecal mass, so that a hard fecal mass results. (6) Spasm of the intestine as a result of abnormal irritability or the presence of irritating material, or both. Psychogenic influences may be a factor in this type of constipation.

Constipation may be classified in three general groups: atonic, spastic, and obstructive. The terms are self-explanatory.

In *atonic constipation* there is decreased muscle tone. The diet must be planned to stimulate the colon to evacuate normally. In the majority of cases this is best accomplished by foods with high roughage content; foods which will swell and retain their moisture, such as agar; foods which will act as lubricants, mineral oils, fats, and oils in general; gas-forming foods which will lighten the fecal mass and stimulate by pressure; and through abundance of water. Vitamin intake should be adequate, especially the vitamin B_1 factor, which has specific effect on intestinal tone. Nicotinic acid and pantothenic acid are reported to be concerned with intestinal motility, hence are important in this condition also. The establishment of regular habits of evacuation is advised and exercise to increase muscular tone.

Spastic constipation is essentially the opposite of the atonic type. In this condition the colon is subject to contractions or spasms accompanied by pain. This increased irritability may be the result of excessive use of laxatives or enemas, overingestion of condiments, alcohol, or of foods which leave a harsh roughage, such as bran (see discussion of Bulk in the Diet). A diet planned to stimulate as little as possible the highly sensitive intestinal mucosa is used in this disorder. Logically it will be a smooth diet, devoid of spicing and condiments; it will include no gas-forming foods or stimulating foods, and at the same time it will be adequate for optimum nutrition. The diet for convalescence is satisfactory, and it is possible that such a diet will have to be followed indefinitely. In some cases high fat diets are of value, but not in cases where alternating diarrhea and constipation occur. The organic

salts and acids of fruits have a mild laxative and stimulating effect on peristaltic action and may be used liberally in this type of constipation. Excess use must be guarded against to prevent overlaxation.

Obstructive constipation results from block, of varying degrees of completeness, and necessitates surgical intervention. Until operation takes place, the diet must be without residue and must not be gas-forming. The liquid or soft diet is used.

Diarrhea is the reverse of constipation, a condition characterized by too frequent stools with more fluid consistency than normal. There is inadequate absorption of water by the body as the intestinal contents pass with unusual rapidity along the tract, or there is outpouring of water into the colon. Diarrheas are described as functional and organic. Kantor classifies the functional diarrheas as those which may occur in the normal person whose intestinal tract is exposed to an irritant, or who is allergic. They may occur as the result of putrefaction or fermentation, achlorhydria, endocrine disturbance, sprue and pellagra, nervousness, and a compensatory type associated with uremia or cutaneous burns. The organic diarrheas are caused by bacterial or protozoan invasion, poisons, and diseases, such as ulcerative colitis and regional ileitis.

The character of the stool, as determined grossly, microscopically, and chemically, gives evidence of the type of diarrhea and the causative agent. When these are known, the diet may be adjusted to combat or correct the abnormality. While gross examination does not always differentiate, a foul-smelling, dark brown alkaline stool, for example, is in general due to putrefaction (proteolytic decomposition), and a light yellow acid stool showing gas bubbles, is probably due to fermentative action on carbohydrate.

Putrefactive diarrhea resulting from bacterial action on protein requires a high carbohydrate, low protein diet. If the diarrhea is caused by fermentation, however, the diet should be high protein and restricted carbohydrate. A fatty stool is indication of an inability to utilize fat normally. If starch particles are present, starch must be restricted and a higher protein-fat diet used. Only general rules can be given, including the use of smooth, nonirritating, concentrated diets if the condition is chronic.

Liberal fluid intake must be provided to prevent dehydration. Vitamin and mineral adequacy can be assured only by increased intake as in the rapid passage of matter in the intestine; normal absorption cannot take place. Mucosa integrity must be maintained in spite of altered intestinal contents and motility. Vitamins are important for this purpose.

In acute diarrhea water and minerals are important considerations, and both must be taken in liberal amounts. The diet should be drastically limited, and nothing should be given by mouth during the first twenty-four to forty-eight hours except water, tea, or broths. After this, gruels, baby foods, cream soups, and milk which has been boiled (to reduce the size of the curd) are all well tolerated. Some physicians prefer not to include milk in the list. Later tender meat may be added to the diet. Fats, fruits, and sweets are contraindicated during an acute attack because of their laxative action. As the patient improves, the soft diet becomes the diet of choice and is followed by the diet for convalescents which is continued until normal diet may be tolerated.

If the diarrhea is of the nervous type, treatment must be directed toward removing or relieving the cause, which may be psychic or due to mental or physical strain.

Frequently diarrhea, either chronic or acute, is a complicating symptom in nephritis, diabetes, paratyphoid infection, cholera, or other intestinal infection, or may be due to inorganic poisons, such as arsenic, mercury, iodide, or antimony. It may result from an allergy or from an overindulgence in food, or food that is laxative in nature or has been contaminated. The causative factor and also the extent of tissue involvement will determine the corrective or alleviating diet. But in general, the regime given above should prevail (see discussion of Colitis, Chapter XXXIII). Sedatives, antispasmodics, and constipating medicine may or may not be necessary. Bed rest during an acute attack is mandatory.

Intestinal auto-intoxication is a much abused and vaguely used term, indicating that poisons elaborated in the intestine are absorbed by the blood and passed through the circulation, leaving a trail of ills. The theory is that protein is the chief offender, and that the indican of the urine is a measure of the intensity of the reaction. As a matter of fact, poisons which are found in the intestinal tract are normally destroyed either in the intestinal mucosa or in the liver (see Chapter XXXIV, discussion on func-

tions of the liver). Alvarez, in his review of the subject of intestinal intoxication as a cause of disease, is quoted by McLester as offering the Scottish verdict of "not proved with an evident leaning toward not guilty."

Flatulence or gas formation is a distressing and frequently found symptom. It occurs in health and in various disease conditions. Excessive gas production, inadequate expulsion, or faulty absorption may be underlying causes. The habit of "gas swallowing," bacterial action, allergy, loss of intestinal tone, and secretion of blood gases into the intestinal tract, all contribute to this condition. Certain foods are known to be gas-forming in some individuals, but not in all. Cabbage, cauliflower, Brussels sprouts, turnips, onions, and the legumes are gas-producing and are rich in hydrogen disulfide (H_2S). Melons, spinach, cucumbers radishes, and raw apples are also in this category. Carbonated waters and mineral waters may cause discomfort. Molasses, honey, and maple syrup and maple sugar are also offenders. All these foods may at times be valuable because of this very property, for gas leavens the fecal mass and is an aid in combating constipation.

Correction of flatulence requires elimination of the offending foods, or perhaps just an improved method of cooking. Hughes reports studies on healthy adults with whom certain foods disagreed and found cooking methods to be an important factor. Overcooking, with resulting formation of decomposition products, definitely increased the number and intensity of the symptoms. Retention of volatile acids, by cooking the food in a covered kettle, also favored the decomposition of the sulfur compounds. Cooking vegetables until just tender not only preserves vitamin content but increases the digestibility. For maximum preservation of vitamin content, cooking vegetables in a small amount of boiling water in tightly covered vessels is the approved method and should be strictly adhered to *except* in cooking "strong flavored," or more accurately, "sulfur-containing" vegetables. With such vegetables, vitamin loss is sacrificed to digestibility.

The use of smooth diet reduced somewhat in carbohydrate, and from which rich foods and concentrated sweets are eliminated, may also be of value. The diet for convalescence is well adapted here. Eating and health habits, and psychic factors should be examined critically as possible contributors to the condition.

Review Questions

What are some of the causes of constipation?

What three general types of constipation are recognized?

What is the aim in the dietary treatment of the atonic type? The spastic?

Can the obstructive type be treated by diet?

Is diarrhea a disease entity?

What are some of the causes of diarrhea?

If the diarrhea is putrefactive, what changes in diet should be made? If fermentative?

In acute diarrhea what regime should be followed?

What are some of the underlying causes of flatulence?

What foods are likely to be gas-forming for some individuals?

In addition to the elimination of the offending foods, what else may be done to relieve this condition?

CHAPTER XXXVII

THE NEPHRITIDES

In order to understand the dietary treatment effective in diseases of the urinary tract, a brief statement of the kidneys and their functions is in order.

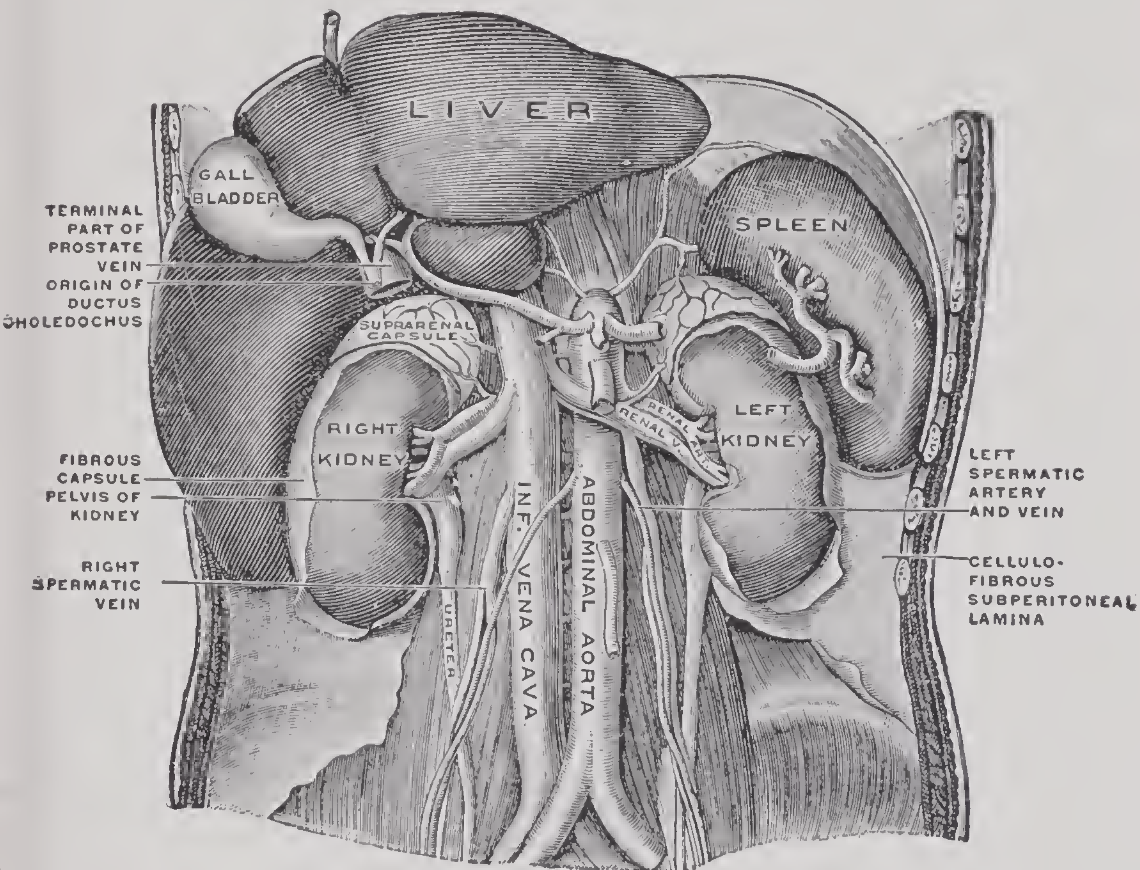
The kidneys are paired, bean-shaped organs, about 4 inches in breadth and 1 inch in thickness, placed to the right and left of the vertebral column, just below the diaphragm. The aorta and inferior vena cava pass between them and assure them of a copious supply of blood.

Long winding tubules, originating near the surface of the kidneys, can be seen microscopically. These are secreting units, conducting urine toward the concave border. A knot of capillaries (glomerulus) appears at the beginning of each tube. Traveling contractions (peristaltic waves) propel the urine through the ureters into the bladder.

Urine is a yellowish liquid, colored by the substances related to bile pigments. Under ordinary circumstances of diet and health, urine is slightly acid. It becomes alkaline, however, on standing, due to bacterial fermentation of urea and formation of ammonium carbonate. As the result of the change, an ammoniacal odor develops and a cloudy deposit may appear. About seven-eights of the nitrogen excreted in the urine is in the form of urea. The remainder is divided among various other nitrogenous waste products, one of which is uric acid, a substance distinguished by its scant solubility and consequent tendency to be retained, as in gout (see Chapter XXX).

Inasmuch as all proteins contain sulfur, and some contain phosphorus, and since these leave the body by way of the urine, phosphates and sulfates, in solution, are found there as well as considerable amounts of sodium chloride. In addition, small amounts of creatine, creatinine, hippuric acid, acetone bodies, and other constituents are present. When any of these constituents exceeds in either direction the normal range found in health, it assumes physiologic importance and is of diagnostic value. Such findings are indicative of the location and extent of metabolic dysfunctions.

The blood, which is the precursor of these urine constituents, likewise will reflect metabolic abnormality. To maintain normal composition of the blood is the main function of the kidneys. When the kidney function is impaired, there is piling up of these constituents in the blood. The reader is referred to the Appendix, where the important constituents of blood and urine are listed with their physiologic levels.



84.—The kidneys and the urinary bladder. The two kidneys are shown within the body cavity. Their advantageous connections with the chief artery and vein of the system are indicated. Below is the bladder, reached by the two ureters. These vessels enter the bladder low down and behind, not at the level where they disappear from the figure. (After Soppey, from *Gray's Anatomy*, Lea & Febiger.)

The quantity of urine is influenced by many factors, chief of which is the fluid intake, and next the activity of the sweat glands. It is important that whenever possible fluid intake be such that the dissolved solids in the blood, which are removed by the kidneys, shall have adequate solvent to facilitate the excretion from the body. Between 1 and 2 liters of urine are normally excreted daily (see Chapter XII, Water Balance).

Nephritis

Nephritis, or Bright's disease, is a general term used to designate altered kidney function due either to inflammatory process or to degenerative change. The classical description of the general condition was given by Richard Bright (1789-1858) in 1827. He described the dropsy, albuminous urine, and other related pathologic conditions seen in this disease. Since then the terms Bright's disease and nephritis have been synonymous. Attempts have been made to classify or to differentiate the types by indicating the location or type of lesion, such as glomerulonephritis, nephrosclerosis, etc. The nephritic condition may be subacute, acute, or chronic, and it may be complicated by edema, uremia, hypertension, and gastrointestinal disturbances.

In **acute nephritis** the diet is directed toward the immediate relief of the kidney, caloric requirement or normal balance of food constituents being ignored, inasmuch as the condition is of short duration. Protein is reduced to low level and should be given in the form of milk or milk and eggs. The Karrell diet, so frequently used in acute nephritis, is an entirely milk diet. If its monotony can be endured, it is commonly used during the first seven days, after which it is modified to include other foods (see Chapter XXVII on Diet Therapy). The Karrell diet consists of 800 c.c. of milk, given as four feedings of 200 c.c. each. It provides 550 calories, 26 gm. of protein, 40 gm. of carbohydrate, 32 mg. of fat, 1.6 gm. of sodium chloride, and approximately 800 c.c. of water. If nausea and vomiting occur, fruit juices padded with extra sugar may be of value, and may be the preferred form of nourishment for the first several days.

The total fluid intake, unless edema is present, should be adequate to render the dissolving of the urinary solids easy. If edema is present, liquids must be restricted to 800-1,000 c.c., and sodium chloride to about 3 gm. or less. Salt restriction is necessary only when edema is present. See Table 106 for sodium content of foods.

As quickly as possible the protein intake should again reach the level of approximately 1 gm. per kilogram of body weight in order that the body protein stores may be protected.

Harrop believes that from the dietary standpoint **chronic nephritis** is a wasting disease and that maintenance of nitrogen

equilibrium is essential. The dietary calculation, therefore, should be based on preferred body weight, rather than on actual weight. The nutritional condition of the patient is important, and since adjustment is made necessary by the deranged kidney function, compensatory provision must be made to prevent a deficiency from occurring. If obesity is not a factor, the normal calorie intake should be allowed. If the calorie intake is below requirement, protein will be burned unless fat stores are available for use. The burning of body protein is undesirable.

In years past, drastic protein restriction was practiced. This led to protein deficiency which was harmful. Today adequate protein is permitted, except in the acute stage.

If there is interference with the normal exchange of fluid between blood and tissue spaces, and the fluid in the tissue spaces is abnormally high, a condition known as edema (oedema) exists. This may be brought about by several conditions. A low serum protein level in the blood results in a nephrotic edema; when the blood protein falls below 4 per cent, edema nearly always appears. An increase in capillary wall permeability—nephritic edema, and an increase in pressure within the capillaries, caused in part by an increase in venous pressure which results from impaired heart action, produces a cardiac edema. Edema may also result from failure of the body to dispose of salt normally, and from nutritional deficiencies—deficiency edema or war edema.

The relationship between salts and edema plays a role in many diseases (see Chapter XI). Drastic restriction of salts may be extremely detrimental, and excess amount may likewise be detrimental. Hence, the logical plan is to meet normal daily need, even though theoretically very low intake may be desired. If edema is present, restriction of salt intake to maintenance level is indicated. This can be accomplished by the simple expedient of using only moderate amounts of sodium chloride in cooking, adding no extra salt at the table, and by omitting all salted foods. These precautions will reduce salt intake to approximately 3 gm., which is a minimum intake. Salt-free diets, in which no salt is used in cooking, and the salt is soaked out of vegetables and meats, are unpalatable and result in mineral deficiencies that produce anorexia which may have serious complications.

Newburg suggests that an acidic diet is effective in reducing edema through withdrawal of sodium from the tissues. Sansum,

on the other hand, feels that an acidic diet renders the work of the kidneys more difficult, and for this reason prefers a predominantly basic diet. The general consensus is that a slightly alkaline ash is optimum (as in normal diet) except where specific alteration is needed to combat stone formation or infection (see Urolithiasis, Chapter XXXVIII).

Anemia is frequently a complication, and foods rich in iron or in substances essential to blood regeneration should be planned.

Uremia appears when function impairment is so acute that accumulation of waste products takes place in the body, due to renal insufficiency (inability to excrete waste products). When this occurs, radical adjustment is again necessary. True uremia is characterized by depression, drowsiness, and lethargy, and finally coma. Headache, nausea, and vomiting further complicate the condition. There is retention of urine and acidosis. Protein, therefore, must be reduced to a low level, and acidosis must be combated by the use of sugar-padded fruit juices. High fluid intake, unless circulatory disturbances counterindicate, should be the rule.

Acute Hemorrhagic Nephritis (glomerular nephritis) is an inflammatory disease that affects the glomeruli. It has an acute onset, with hematuria in varying degrees, proteinuria, edema, hypertension, and usually nitrogen retention. McLester points out that one of the hazards of the disease is the fact that it may subside into a latent stage which results in false security since it may last for years, only to flare up again. The condition often follows streptococcus infection as an aftermath of tonsillitis or scarlet fever by invasion of the infecting organism into the kidneys. It is essentially a disease of youth. Seegal and his associates in their study found that 50 per cent of the patients were under 10 years of age, and 70 per cent were under 20 years.

The diet in the acute stage, which is frequently accompanied by nausea and vomiting, is usually limited to carbohydrate-padded fruit juices. From this the patient progresses to the milk diet and a gradual change to low salt, soft diet, which at the end of ten days may gradually approximate the normal diet.

Edema, being a usual tendency, brings the need for salt restriction. The fluid intake should balance the fluid outgo with an excess equal to approximately the volume of the urine on the previous day.

When the condition becomes **chronic,** the nutrition of the patient is an important consideration. Protein must meet the daily wear and tear quota, and it must also replace the albumin lost in the urine—from 1 to 1.5 gm. of protein per kilogram (75 to 100 gm. of total protein) should be included along with an increased carbohydrate intake. The salt level in the chronic stage will depend upon the presence or absence of edema.

Nephrosis

Nephrosis is a degenerative type of Bright's disease, rather than an inflammatory process in which the changes are confined to the tubules. Nephrosis is insidious in its onset, and usually follows an infection or an intoxication. It is characterized by profuse albuminuria, low serum proteins, edema, lowered basal metabolic rate, and anemia. Hypertension and urine retention are not characteristics of this condition. The symptoms of the disease indicate the dietary treatment. High protein intake, up to 2 gm. per kilogram of body weight, i.e., normal requirement plus the amount lost in the urine, increase in carbohydrate level and salt restriction, characterize the diet plan. At times there may be a high fat and cholesterol level in the blood, lipoid nephrosis. If this occurs, the dietary fat must be restricted. It is believed by some that lipoid nephrosis is not a true kidney disease, but is due to general metabolic disturbance.

Nephrosclerosis

Involvement of the circulating system, as well as reduction of renal function, results in nephrosclerosis, or arteriosclerotic Bright's disease. It is a vascular disease, which in its latter stages is accompanied by impairment of the kidneys. The symptoms include arterial hypertension, cardiac hypertrophy, some proteinuria, vague digestive disorders, and headache. Later, as the condition advances, the heart becomes greatly enlarged, and symptoms of myocardial incompetency appear. Finally, nitrogen retention and eye (retinal) changes become manifest. At the end of a long course death usually results, from circulatory failure rather than from renal insufficiency. The diet adjustment consists of an easily digested adequate diet, chosen from the foods suggested in the Diet in Convalescence, Chapter XXVII. This

diet is free from highly spiced and rich foods that may result in digestive upsets. Salt should not be excessive, but reduction is not necessary.

To summarize the dietary adjustments in the several types of renal disease, the following points must be kept in mind: When nitrogen retention is excessive, the protein level must be reduced. When there is neither retention nor proteinuria, the level should be that of the normal diet; but when albuminuria is present, the protein must be increased as compensation.

When edema occurs, salt intake should be reduced to approximately 3 gm. At other times there is no need for restriction. When edema or cardiac insufficiency is present, limitation of water is necessary. If these are absent, the intake of water may be governed by thirst.

In the presence of high blood fat and blood cholesterol the fat intake should be limited to a low level. Otherwise the diet should be adequate as to calories, except in acute stages or where weight loss is desired. The diet should have a somewhat higher than usual level of carbohydrate. It should meet the normal need for vitamins, be free of high spicing or condiments, or any constituent which may be irritating. The diet should be adjusted (unless contraindicated) to leave a neutral or slightly alkaline ash.

Review Questions

What diet is often prescribed for a patient with *acute* nephritis?
Of what does this diet consist? What purpose does it serve?
If not well tolerated, how else may nourishment be given?
Should fluids be forced or restricted?
Under what condition is salt restriction necessary?
What is considered a minimum salt intake?
How may this minimum intake be accomplished?
Is protein restriction advisable in *chronic* nephritis? Explain.
What is the importance of adequate calories?
Should the diet be predominantly acidic or basic?
What means should be used to combat anemia if present?
What dietary measures must be instituted if uremia appears?
What nourishment may be given in case of acute hemorrhagic nephritis?
If the condition becomes chronic what dietary considerations are important?
What is the diet plan in nephrosis? In nephrosclerosis?
Summarize the dietary adjustments necessary in the various types of kidney disease.

CHAPTER XXXVIII

OTHER ABNORMALITIES OF THE URINARY TRACT

Urinary Tract Infections

Pyelitis, inflammation of the pelvis of the kidney, or pyelonephrosis, and cystitis, inflammation of the bladder, are all infections of the urinary tract. Treatment is directed toward the elimination of the infecting organisms. Forcing fluids and alteration in urinary pH are of value. These may be brought about by adjustment in acid-base balance and by the use of the ketogenic diet, which is also acidic. This diet, as pointed out under Epilepsy, Chapter XLI, is difficult to follow.

Recently the sulfa drugs, sulfanilamide, sulfapyridine, etc., and mandelic acid have largely superseded dietary adjustment, although there is greater effectiveness when dietary adjustment is also made. This is especially true when mandelic acid is administered. The object is to increase the acidity of the urine to the point that infecting organisms cannot grow. An acidity of approximately pH 5.2 (5.5 to 5.0) seems effective.

Supersaturation of Urine

Under the influence of the colloids of the urine, greater concentration of salts is possible than in a simple watery solution. When there is interference with this physiochemical equilibrium, precipitation of salts can occur, but this is not a disease condition. It is a metabolic disturbance. A number of salts may be so affected.

Phosphaturia occurs when phosphate crystals are thrown out of solution. This results in a milky, cloudy urine, and frequently occurs in nervous tension or nervous upsets. Treatment consists in quieting the nerves, the ingestion of an acid ash diet to favor phosphate solution, and a diet low in calcium, which also tends to increase the solubility of the phosphorus. The diet naturally should be low in phosphorus. Phosphorus-containing foods, such as meat and cereals, should replace milk, eggs, and green vegetables as far as possible, without interfering with adequate nutrition.

Oxaluria indicates that calcium oxalate crystals are being precipitated. This may take place in either an acid or an alkaline urine. Foods rich in oxalates, spinach, beans, tomatoes, figs, strawberries, potatoes, plums, cocoa, chocolate, and tea should be avoided. Bread, muscle, and glandular meats contain some oxalate and should, therefore, be eaten in moderation. Foods containing little or no oxalic acid, such as dairy products, fats, rice, peas, cabbage, asparagus, mushrooms, apricots, grapes, and melons should form the greater part of the diet (see Appendix for oxalic acid content of foods).

Urates, when deposited, result in a condition known as uraturia. The precipitation takes place in acid urine. The rendering of the urine alkaline, and a decrease in uric acid (purine) intake are effective in controlling the condition. The elimination of uric acid requires omission of all glandular meats, whole grain cereals, certain vegetables, etc. (see Gout).

Cystinuria, as the name implies, is a deposition of cystine. Under ordinary circumstances, cystine is destroyed and appears only in minute traces in the urine. In such conditions the urine should be rendered alkaline, and sulfur-rich foods should be curtailed. Milk should be the chief source of protein, since it is high in biological value and low in sulfur. Eggs may be used in moderation. Meats should not be used at all. Occasionally the metabolic disturbance may be such that other amino acids may also appear in the urine.

Alkaptonuria is a disease in which the intermediary metabolism of protein in the liver is disturbed. The urine becomes dark upon standing, due to the presence of homogentisic acid, which is derived from the amino acids tyrosine and phenylalanine. Therefore, these acids must be restricted. Proteins in general should be reduced to maintenance level. Milk, cheese, and cream are important sources of tyrosine and should, therefore, be restricted.

Renal Calculi (Urolithiasis)

When excessive precipitation of urates, oxalates, or phosphates occurs, "stones" may be formed in the kidney. These are usually combinations of all three salts, but with one salt predominating. Infection and deficiency of vitamin A are probably causative. Symptoms of vitamin A deficiency can usually be shown to co-

exist with stone formation. The dietary treatment will depend on the type of stone and the associated symptoms. Dietary changes suggested for oxaluria, phosphaturia, etc., are applicable to stones as well. The pH adjustment may be dietary and chemotherapeutic. High vitamin A intake is important here as in all infections of the urinary tract. Dietary history frequently will show that fat restriction has existed, which means that vitamin A inadequacy has permitted changes in the epithelial tissue lining the urinary tract. Inadequacy of vitamins C and B also predispose to infection. Too high carbohydrate intake and prolonged use of mineral water, endocrine disturbance, and kidney malformation are all contributory causes of this condition.

Cystinuria and alkaptonuria are somewhat hereditary in occurrence. This is not true of other types of stones. While stones may occur at any age, about 50 per cent appear between 30 and 50 years of age and slightly more often in the male. There may be countless small stones the size of a pin point, or large stones, even as large as an orange.

The presence of a stone brings on vague discomfort in the region just under the ribs, in the back, and about 2 inches from the spinal column. This is accompanied by tenderness and a disinclination to move. Sudden, sharp, knifelike pains, radiating down around the lower part of the abdomen may occur. Urine is scanty, but the desire to urinate is frequent. Blood may be present in the urine as the result of trauma to the ureter from the stone. When the stone has passed into the bladder, the pain ceases. Inasmuch as the stones may form at intervals, all possible dietary adjustment should be made and continued as preventive measures. While dietary adjustment does not always bring about the desired results, a liberal water intake, elimination of possible causative food factors, increased intake of vitamins A, B, and C, elimination of foci of infection, and avoidance of infections, in addition to observance of the general rules for good health and hygiene, should be included as part of the treatment.

Review Questions

What dietary adjustments may be effective in cases of pyelitis and cystitis?

Precipitation of various salts in the urine may occur. What food restrictions should be made in the following:

a. Phosphaturia?
b. Oxaluria?
c. Uraturia?
d. Cystinuria?
e. Alkaptonuria?

If there is excessive precipitation and kidney stones are formed, what are the dietary indications?

What role does vitamin A play in these conditions? Vitamins C and B?

CHAPTER XXXIX

CIRCULATORY DISTURBANCES

Diseases of the kidney and diseases of the circulatory system are so intimately connected that one cannot be discussed without reference to the other. Malfunction of either soon results in complication within the other. The role of the heart needs little comment. It is the pump that sends the blood throughout the body on its mission of food supply and waste collection. The heart may not function normally; there may be changes in the arteries or veins. The kidney may not effectively remove the products intended for urinary excretion. The interrelationship is obvious, and complications in any one condition frequently result from association of other factors.

The force with which the heart contracts as it expels blood may be measured. A measurement of blood pressure is a common procedure. With the sphygmomanometer (the blood pressure cuff is an example) it is possible to determine the amount of pressure needed to block the passage of blood through an artery. This systolic pressure represents the tension to which the blood vessels are subjected under the full force of the heartbeat as the heart contracts. As the pressure is released, and the blood again flows through, a second pressure level is determined, the diastolic pressure, or minimum strain put upon the arteries. This is the decrease in force of pressure as the heart dilates, or its period of greatest relaxation. Any abnormality in the heart or in any of the blood-carrying vessels will be reflected in these pressure values. While systolic blood pressure varies with age, sex, general health, heredity characteristics, time of day, eating habits, climatic conditions, state of mind, etc., certain average values can be assumed. Woley's values for systolic pressure are given below:

Age	Average Systolic Pressure
15-30	122
31-40	127
41-50	130
51-60	132

A persistent systolic pressure over 150 is usually regarded as significant, and is spoken of as *hypertension*.

The causes for hypertension may be organic or functional. By organic is meant a structural change in the heart, blood vessels, kidneys, or other organs—a change which will persist. Functional change may be due to an emotional upset or a transitory cause of some kind. Infection and obesity are frequent causes.

Cardiac Dysfunction

The heart itself may suffer functionally or organically, and various parts may be affected: the pericardium or outer covering, the myocardium or heart muscles, or the endocardium or membranes lining the heart.

The stage in which the dysfunction exists is also of importance. In the first stage circulation is normally maintained, although the heart enlarges and beats more rapidly in an effort to compensate. In the second stage the heart labors, the myocardium is affected, and the burden of forcing forth blood is met with difficulty. Dietary adjustment can be of help in this condition. In the third stage there is no longer any compensatory adjustment. This is a state of decompensation; the condition has become chronic. Dietary adjustment, aimed at relief of strain, is imperative at this stage.

The logic of dietary adjustment instituted to relieve this cardiac strain is easily understood. The work of the heart must be saved as far as is compatible with good nutrition. As obesity may be a prominent factor, it should receive first consideration in planning the diet. McLester outlines the disadvantages of obesity as fourfold. First a lack of balance between the body mass and the heart strength, an undesirable condition even when the integrity of the heart is unimpaired. Secondly, the heart may be the seat of abnormal fat deposits, on the surface and between the muscle bundles. This condition naturally decreases muscular efficiency. Thirdly, accumulations of fat in the abdomen may limit free movement of the diaphragm and in turn limit the free movement of the heart. Fourthly, arteriosclerosis, which frequently accompanies obesity, may involve the coronary artery which supplies the blood to the heart muscles.

It is evident that return to normal weight or a slight state of undernutrition is desirable. Caution must be used in attaining this state, for drastic reduction is not desirable. The reduction diet should be planned to be entirely adequate to maintain good

nutrition while a slow steady weight loss is brought about. Glucose has beneficial effect on the myocardium, and a high carbohydrate diet is, therefore, indicated. Liberal vitamin B_1 is recommended, or, better, the use of the entire complex, inasmuch as it has been beneficial in the cardiac changes accompanying pellagra and experimental data indicate the importance of the synergistic (working together) action of the vitamins of the B group. There is also evidence that vitamin C has something to do with myocardial health. Protein must be adequate in order to spare tissue protein. Low serum protein is not uncommon in the latter stages of cardiac dysfunction. Dynamic action is not desired and, therefore, adequate but not excessive protein is indicated.

The diet must be planned to prevent digestive upset and flatulence; therefore, readily digested foods, such as given in the diet for convalescence, are most suitable. Curtailment of fat is advised in the interests of rapid gastric evacuation.

To prevent edema, which would put added strain on the heart, a moderate intake of water and sodium is to be preferred to liberal supplies. If edema is present, the usual restriction of water and sodium will be employed.

When the cardiac involvement is part of a syndrome of other conditions, such as rheumatic fever, the suggestions given under Diet Therapy, Chapter XXXI, will be of value.

In coronary occlusion, water, fruit juice, and milk should be the only food offered during the acute stage. After this has passed, there may be a gradual return to more normal diet.

Arteriosclerosis

The exact cause of arteriosclerosis is unknown. Heredity and constitutional predisposition would seem to play a part, but in any event the circulation is impaired. Whether hypertension is a cause or an effect is a matter of theory. The hardening occurs with a fatty infiltration of the lining of the blood vessels and a deposition of calcium salts. The strain upon the heart in forcing the blood through the now unelastic vessels would be a reasonable cause of hypertension.

Dietary treatment is directed toward decreasing the burden thrown upon the heart and the sclerosed vessels. The suggestions given under Hypertension apply here.

Hypertension

Hypertension is not a disease per se but rather a symptom which may result from many causes. Both the underlying cause and the hypertension require treatment.

Hypertension is a condition in which persistent elevation of blood pressure above average occurs. Heart and renal involvement are logical sequences. Diet therapy is intended to relieve the strain on the vessels involved. That mild undernutrition is desirable to attain this end is generally accepted. How this condition should be brought about and how extensive it should be has been a matter of conflicting ideas. There have been advocates of low protein intake, of restriction of salt and of water and the use of alkaline ash diets.

Experimentally, there is little evidence that high protein intake is conducive to high blood pressure, popular opinion to the contrary. There seems to be little to prove that *moderate* amounts of salt and water are harmful. The diet pattern which accordingly developed was one less drastically modified than the earlier ones. The major alteration was in caloric intake—an adjusted level adequate to produce and maintain the desired weight.

The fat level of the diet was held slightly below the normal ratio of fat to the other constituents—especially the animal fats due to their cholesterol content. There is some evidence suggesting that fatty deposits along the vascular walls may effect the hardening process. Restriction seemed sensible pending the accumulation of more data. Otherwise the diet was the same as that recommended in health, but with each item more strictly *held in moderation*. In fact, moderation was the key to treatment. Moderation in eating, drinking, smoking, physical and mental effort and emotional stress, the mental-emotional side perhaps having even greater emphasis than the dietary. Certainly, there is no clinical condition in which peace of mind, tolerance, cheerfulness, relaxation, rest, and moderate exercise can play a more important part.

This diet still has staunch supporters.

In the past several years there has been a swingback to more drastic restriction. Interest has centered around the "*Rice Diet.*" This diet, first proposed by Kempner, consists of rice and

fruit—a diet low in protein, fat, and salt. This diet was planned to impose a "minimum of strain on kidneys whose metabolic activity was already altered," the hypertension being considered a result of this disturbed metabolism. For example, a 2,000 calorie diet would contain approximately 20 gm. of protein, 5 gm. of fat, 450 gm. of carbohydrate—about 0.2 gm. sodium and a total intake of approximately 1,000 c.c. The patient is continued on this starch diet for a period of three months. If at the end of that time some blood pressure lowering has been effected, dietary additions are slowly permitted.

For example,* an egg a week and a nonleguminous vegetable and a cup of tea or coffee is added to the diet. At the end of a month 4 oz. meat, fish, or liver is included three times weekly, with two slices of salt-free bread. A month later this is increased to a serving of meat daily, a second nonleguminous vegetable, and an egg three times weekly. At the end of this month, if progress has continued to be satisfactory, egg and potato are allowed daily.

A multiple vitamin preparation is prescribed throughout to guard against possible vitamin deficiency.

As one would expect, this is a diet of extreme monotony as well as one lacking in palatability. Special care must be used in its preparation. Experience shows that, as a result of this diet, blood pressure is lowered in approximately two-thirds of the patients treated.

Even more in vogue, currently, than the rice diet is the low or *restricted sodium diet*. Its current widespread use also warrants a short comment. Gratifying results are reported, although opinion differs as to the extent of restriction necessary. There is a general agreement that it is sodium and not sodium chloride which needs restriction. Just why reduction should relieve hypertension is not clear. Again strict dietary treatment perhaps is justified in spite of insufficient information as to its specific action.

The low sodium diet was devised to reduce sodium intake to as low a level as possible without too drastic restriction of total food. Since no foods are completely devoid of sodium, this is a factor of consideration.

*New England J. Med. 239: 531, 1948.

Table 91

Daily Diet Containing Approximately 200 mg. Sodium (Equivalent to 510 Mg. NaCl)*

FOOD GROUPS	FOODS ALLOWED			QUANTITY
Beverages		Clear coffee Kool Aid Clear tea		As desired
Bread	Yeast bread made without salt			3 slices
Cereals	Any uncooked, unsalted cereal; macaroni or spaghetti may be substituted for 1 slice of bread			½ cup
Fat		Any unsalted fat		As desired
Fruits	Apples Apricots Bananas Blackberries Cherries Cranberries Gooseberries	Grapefruit Grapes Lemons Mulberries Oranges Peaches Pears Pineapple	Plums Prunes (fresh or stewed, 3-4) Raspberries Rhubarb Strawberries Tangerines	½ cup of any three
Cooked meats and fish	Meat Chicken Lamb Mutton	Pork Rabbit Veal Venison	Fish (fresh, unsalted) Bass Cod Halibut Trout	5 oz. of one
Egg				1
Nuts, unsalted		Peanuts Almonds		50-55 nuts
Potato or substitute		Macaroni (cooked) Potato, white (cooked) Rice (cooked) Spaghetti (cooked)		½ cup of any one
Seasoning		Vinegar Paprika Pepper		Small amounts
Soup		None		
Sweets		Jelly Granulated sugar		3 tbsp. As desired
Vegetables	Asparagus Broccoli Brussels sprouts Cabbage Carrot (¼ cup only) Cauliflower Cucumber	Egg plant Endive Green beans Lettuce Mushrooms Onions Parsnips	Peas Salsify Tomatoes	½ cup of any one

Diet plan taken from University Hospital Diet Manual Rev. ed., 1947, Ann Arbor, Michigan.

*All food is prepared without salt, soda, or baking powder. Only the exact amounts if foods listed should be allowed.

Newburg* outlines a diet pattern which will reduce the sodium intake to 200 mg. (equivalent to 510 mg. sodium chloride) a day. We reproduce that pattern by permission (Table 91).

Meals following this pattern are, of necessity, calorically low—approximately 1,300 calories. Newburg suggests the use of white sugar and salt-free butter, since they contain only negligible amounts of sodium, to make up the additional calories. If 8 tbsp. butter and 4 tbsp. sugar are added, the caloric value is raised to 2,500. He does not consider it feasible to add more.

Milk is limited, due to its sodium content (50 mg./100 c.c.). Recently Lonalac, a specially prepared milk with a low sodium content (2 mg./100 c.c.), has been manufactured by Mead Johnson and Company. Naturally this milk is more costly.

The meats included in this 0.2 gm. (200 mg.) sodium diet must be limited. Their sodium content varies from 70 to 100 mg. per 100 gm.—eggs for the same reason must be limited. The diet is therefore low in protein.

The bread and butter used must be salt free. Commercial bread contains approximately 100 mg. sodium per average slice.

Vegetables and fruits, except dried, have a low value (1 to 10 mg./100), and hence are used more generously.

Unsalted nuts are included for their protein value.

Unsalted oils, vinegar, paprika, lemon juice, garlic, and pepper are permitted seasonings.

Table 92 indicates the schematic outline used for several low salt levels by the dietary department at Strong Memorial Hospital.

Groolman, another advocate of "Sodium restriction as a dietary measure in hypertension," finds excellent response "at times" when the restriction is held down to 0.5 gm. (500 mg.) daily. "Moderate restriction of sodium fails to influence the blood pressure." Results vary with the nature of the underlying disorder and the duration of the disease. To his mind, the results of this treatment seem to justify the diet restriction. However, he concedes the dangers of deficiency and suggests close watching of such patients.

*Newburg and Reimer: J. Am. Diet. A. 23: 1047, 1947.

TABLE 92

LOW SALT (NACL) DIETS

MORNING	NOON	NIGHT
	0.5 Gram Salt Diet	
1 sv. fruit	60 gm. S.F. meat	60 gm. S.F. meat
1 sv. S.F. cereal	100 gm. S.F. potato	100 gm. S.F. potato
60 c.c. 2× cream	100 gm. S.F. veg.	100 gm. S.F. veg.
60 gm. S.F. bread	60 gm. S.F. bread	60 gm. S.F. bread
5 gm. S.F. butter	5 gm. S.F. butter	5 gm. S.F. butter
	1 sv. fruit	1 sv. fruit
	1 Gram Salt Diet	
1 sv. fruit	90 gm. S.F. meat	60 gm. S.F. meat
1 sv. S.F. cereal	100 gm. S.F. potato	100 gm. S.F. potato
120 c.c. 2× cream	100 gm. S.F. veg.	100 gm. S.F. veg.
1 egg	60 gm. S.F. bread	60 gm. S.F. bread
60 gm. S.F. toast	10 gm. S.F. butter	10 gm. S.F. butter
10 gm. S.F. butter	1 sv. fruit	1 sv. fruit
	2 Gram Salt Diet	
1 sv. fruit	90 gm. S.F. meat	60 gm. S.F. meat
1 sv. S.F. cereal	100 gm. S.F. potato	100 gm. S.F. potato
120 c.c. 2× cream	100 gm. S.F. veg.	100 gm. S.F. veg.
1 egg	60 gm. S.F. bread	60 gm. S.F. bread
60 gm. S.F. bread	10 gm. S.F. butter	10 gm. S.F. butter
10 gm. S.F. butter	240 c.c milk.	240 c.c. milk
	1 sv. fruit	1 sv. fruit
	4 Gram Salt Diet	
1 sv. fruit	90 gm. S.F. meat	60 gm. S.F. meat
1 sv. S.F. cereal	100 gm. S.F. potato	100 gm. S.F. potato
120 c.c. 2× cream	100 gm. S.F. veg.	100 gm. S.F. veg.
1 egg	30 gm. regular bread	30 gm. regular bread
60 gm. regular bread	5 gm. regular butter	5 gm. regular butter
10 gm. regular butter	240 c.c. milk	240 c.c. milk
	1 sv. fruit	1 sv. fruit

S.F. = Salt-free.

Landowne,* in an excellent review of the low sodium diet, offers data pro and con and concludes that "the trend seems to be toward a greater and greater degree of salt restriction" but "the place of the low sodium diet in the treatment of hypertension is yet to be established." Its greatest value, he feels, is in the treatment and prevention of the edema of heart failure and nephritis.

So choice remains in dietray treatment. The plan may be moderation in diet and activity, the rice diet may be preferred, or sodium restriction can be practiced. The future and additional controlled studies will give the answer.

*J. Am. Dietet. A. 24: 187, 1948.

For the convenience of those engaged in the different task of planning low sodium diets, the newer figures on sodium values of food (Table 106), prepared by Mead Johnson and Company, can be found in the appendix. Diet outline and food lists are also available from this company.

Review Questions

In what respects are the kidneys and the circulatory system interdependent?

At what point is systolic pressure of the heart considered abnormal or hypertensive?

What are some causes of hypertension?

What is meant by compensated heart disease? Decompensated?

What factors must be considered in planning diet adjustment for a person with heart disease?

What is the principal adjustment necessary for the person with hypertension?

CHAPTER XL

THE ANEMIAS

The term anemia (*a* – without + *emia* – blood) denotes a diminution of the normal number or volume of red blood corpuscles, or in the amount of hemoglobin in a unit of circulating blood. The result of either condition is a lowering in the capacity of the blood to combine with and transport oxygen to the tissues. The number of red blood cells or corpuscles (R.B.C.) and the amount of hemoglobin (Hb.) varies in normal persons with age, sex, geographic location, and degree of activity and hydration of the individual. However, certain approximate normal values may be assumed. Five million red blood cells per cubic millimeter of blood may be considered average for men; for women the number is somewhat less. The cells occupy 45% of the total volume of blood in any individual; the remainder, or 55%, is plasma. Hemoglobin is present in the amount of 14.5 gm. per 100 c.c. of blood or 14.5% of the total volume (see Chapter VIII, Blood). Blood makes up approximately 7% of the body's weight, but it contains 70% of the body's iron. Alteration in these values and consequent lowering in the oxygen supplied to the tissues produce symptoms such as headache, faintness, weakness, abnormal fatigue, increased sensitiveness to cold, irritability, and lack of power of concentration. In severe anemia these are intensified, and gastrointestinal upsets, difficulty in breathing, heart murmurs, etc., may be added to the symptomatology. Certain symptoms are characteristic of a type of anemia and so are helpful as differentials.

In order to build red blood cells, normal in kind and number, the bone marrow must have available protein, iron, vitamins B and C, and the thyroid hormone. Further, once the cell is formed, it requires the stimulus of a substance produced in the stomach wall ("a specific erythrocyte-maturing substance") if it is to mature and leave the bone marrow. Under normal conditions bone marrow produces 1,000,000,000,000 red blood cells a day. In health an equilibrium is maintained between blood formation and blood destruction, and if this is disturbed, anemia results. The span of life of each red blood cell is probably from 60 to 90

days. Eventually it is broken up and "scrapped for junk" after the iron is salvaged for re-use. The rest of the hemoglobin molecule is converted into bile pigment, and after playing its part here, it leaves the body by way of the feces to which it imparts the characteristic color.

Anemias are described as hyperchromic or hypochromic, depending upon the color index, or upon the amount of hemoglobin present. As is evident from the terms, hyper indicates that more than the average amount of hemoglobin is present, and hypo, that the hemoglobin is below average. The descriptive adjectives microcytic, normocytic, and macrocytic may be used in addition to indicate the size of the cells—less than average, average, or greater than average in size.

Primary and secondary are terms formerly used in describing anemias, primary indicating failure of the bone marrow to produce normal red blood cells, and secondary indicating an anemia as the result of factors other than cell production, such as blood loss, food deficiency, pregnancy, etc. This grouping is, however, being replaced by more detailed descriptions.

Classification of the anemias is difficult because of the many complications and causes. Several classifications have been suggested. A simple one follows:

Deficiency anemias. Under this heading may be grouped the deficiencies due to lack of iron or hemoglobin-producing foods. Infants fed too long upon a milk diet frequently develop anemia due to the low iron content of milk. In pregnancy, if intake of food is below utilization, or in any condition where the loss of red blood cells exceeds production by the bone marrow, as in hemorrhage, anemia results.

Chlorosis, a disability occurring in young women, was encountered in years past, but today it is rarely described, probably because of better nutrition and diet, and the modern tendency to classify this condition simply as hypochromic anemia due to deficiency. The anemia occurred usually at puberty, the period of rapid growth, or during the establishment of menstruation when the demand for iron is relatively great.

The response to iron therapy in the hypochromic anemias suggests that the beneficial change in condition is due "to relief of a deficiency and not to a stimulation of unspecific nature, since ad-

ministration of iron to a normal individual, or to one suffering from pernicious anemia, does not increase blood production."

In this group also belongs the anemia characteristic of scurvy, brought about by lack of vitamin C, the anemia found in pellagra and beriberi, caused by deficiency of the specific B vitamins (nicotinic acid and B_1), and the anemia which results from hemorrhage following a vitamin K deficiency, with its subsequent prolonged clotting time.

An anemia caused by lack of ability to absorb food normally, occurring in certain gastrointestinal disorders, also belongs to this group.

Inadequacy of protein of high biological value and thyroid deficiency are other causes of anemia. In fact, anemia is often but one symptom of defective nutrition.

This group of anemias is the result of inadequacy of or an abnormal utilization of food. They are curable by proper dietary treatment. An entirely adequate diet, supplemented by the factor whose lack was responsible for the development of the anemia, is the treatment of choice in these conditions. The dietary history and the associated symptoms of the anemia usually reveal the underlying cause of the disease, and indicate what factor or food constituent must be employed to rectify the condition and make the diet entirely adequate in all essentials for red blood cell construction.

Certain foods, notably liver, promote blood regeneration out of proportion to their protein, vitamin, and mineral content. The liver cell, so intimately concerned with pigment metabolism, apparently is the storehouse of the pigment complexes which are the parent substances of hemoglobin. Considering liver as 100% effective in the production of hemoglobin, Whipple and his coworkers arrive at the values given in Table 93.

Summarizing, it can be seen that liver, kidney, and gizzard are the most potent sources of hematopoietic substance. They have the greatest stimulating effect on cell production. The group next highest includes apricots, peaches, apples, and prunes. Following these are the muscle meats, and then a relatively inert group, including the leafy vegetables, dairy products, and cereal grains.

Table 93

Liver, 100%
Chicken livers, 90%
Gizzard, kidney, 80%
Apricots, peaches, 50%
Prunes, raisins, apples, 35%
Lean meat, 35%
Sweetbreads and brains, 25%
Green leafy vegetables, 15%
Eggs, 15%
American cheese, 15%
Butter, 15%
Milk, cream, 5%

Iron or iron and copper medication may or may not be indicated in conjunction with the dietary change, and its use is debated. It is, however, of value in addition to high dietary intake of iron in many cases.

Pernicious anemia or Addison's anemia (not to be confused with Addison's disease) is also a deficiency anemia, since it is due to an inability of the body to produce the factor which has stimulating effect on the maturation of the red blood corpuscles, known variously as the hematopoietic liver principle, the erythrogenic liver principle, and the antipernicious anemia principle or factor. The substance is apparently liberated in the gastrointestinal tract by interaction between some constituent of the gastric juice (called by Castle the *intrinsic* factor), and a water-soluble dietary constituent known as the *extrinsic* factor. The iron supply is adequate but, lacking the intrinsic stomach factor, the individual is unable to manufacture his own liver fraction. This intrinsic factor, when present, is stored in the liver, from whence it is released to stimulate the bone marrow to produce normal erythrocytes, and to release them to the circulating blood. Whipple and Robscheit-Robbins, Minot and Murphy, and also Castle made known the importance of liver and the possibilities of this stomach-liver substance which they prepared. This product has an anti-anemia potency several times that of liver extract alone, and contains both the extrinsic and intrinsic factors. It does not cure pernicious anemia, but controls it so that health is re-established in the victim. Extracts of liver potent for other types of anemia should not be confused with the type specific for pernicious anemia. Foods valuable in hemoglobin regeneration, those rich in minerals, vitamins, and protein, should be an accompaniment to the hematopoietic

substance in the treatment of the pernicious anemia patient. The use of the substance should not replace liver in the diet entirely. The daily diet for this type of anemia should contain, if possible, a serving of liver, kidney, or gizzard, a serving of muscle meat, a serving of apricots, peaches, prunes, apples or raisins, a citrus fruit, a third fruit of some kind, a generous serving of leafy vegetable, a second vegetable and a salad. Cereal products, fats, and sweets should be restricted, and milk should be limited to one pint daily.

In pernicious anemia achlorhydria (low gastric hydrochloric acid), gastrointestinal symptoms such as sore mouth, "beefy" tongue, loss of appetite, diarrhea or constipation, and abdominal pain occur. If the condition is not treated, mental depression, unsteadiness of gait, muscle and joint pain, and loss of memory appear. Pernicious anemia is a disease which involves not only the hematopoietic system, but also the gastrointestinal and neurologic systems as well. Where other abnormal conditions requiring dietary adjustment co-exist, adjustment of the diet must not eliminate the hemoglobin-regenerating foods, even though it may be necessary to administer them entirely as liquids and to give the liver extract by injection.

With adequate treatment, pernicious anemia ceases to be pernicious. The administration of the absent liver fraction, which some animal has manufactured and stored in its own liver, controls the disease and relieves its symptoms.

The ingestion of whole liver is effective treatment for any anemia. Iron therapy is essential when the color index is low. Liver extracts are of great value when the cells themselves are inadequately formed, as in pernicious anemia.

Recently, the reports on the several antianemia factors effective for various animals or organisms have been clarified. These are now assumed to be the same, inasmuch as synthetic folic acid results in similar response in each case. (See folic acid as one of the B vitamins, Chapter X.) Folic acid has corrective action in several macrocytic anemias. Controversy continues as to its complete effectiveness in pernicious anemia. It is one factor, but probably not the only one. More data are constantly being reported. Within the year, vitamin B_{12} has been isolated and used as treatment, alone and in conjunction with folic acid. It appears

to be more effective than folic acid but still probably is not the complete factor.

Another recent report indicates that a very high fat intake predisposes to anemia by rendering the red cells more fragile and more easily destroyed. While this would have no significance for the normal individual with his efficient production of red blood cells, it is a suggestion that for those building new red cells after blood loss, a low fat diet would be preferable to a high fat one.

A second group of anemias results from **interference with blood regeneration** of such nature that red blood cell elaboration (hematopoiesis) cannot take place.

There may be physical injury to the blood-forming organs by prolonged radiation, x-ray, radium, and accidental absorption of radioactive material (in industry).

Mechanical interference with blood-forming organs due to obliteration of potentially active bone marrow which, despite the maximum productivity of the remainder, results in an inadequate number of red blood cells. Carcinoma, acute and chronic leucemias, miliary tuberculosis, or Hodgkin's disease, and occasionally tumors in the bones and osteosclerosis (pathologic bone marrow change) may be the causative agent.

There are also idiopathic disturbances of the blood-forming organs "for which there is no immediate explanation": aplastic anemia, the macrocytic anemia of liver disorders especially of cirrhosis, the so-called splenic anemia and certain congenital erythroblastic anemias (anemia of the premature infant or the type variously called Mediterranean or Cooley's anemia, which was described first by von Jaksch and is occasionally called by his name).

Lastly, there are anemias caused by actual **disintegration of the blood** by the action of infective organisms, intestinal worms, cancer, extensive burns, or hemolytic poisons. In these, dietary adjustment other than directed toward improvement of general health is ineffective.

Review Questions

What does the term anemia denote?

What is the average number of red blood cells per cubic millimeter of blood in healthy men?

What amount of hemoglobin in 100 c.c. of blood is considered normal?

Where are red blood cells formed?

What nutrients are essential to the formation of red blood cells, normal in kind and number?

What is necessary for their maturation?

What is meant by deficiency anemias?

What are the dietary indications in deficiency anemias?

What foods have been found especially valuable in blood regeneration?

In what respect does pernicious anemia differ from other deficiency anemias?

Has a cure been found for pernicious anemia?

How may this type of anemia be controlled?

In addition, what foods should be included in the daily diet?

In addition to the above, what are some other causes of anemia?

CHAPTER XLI

THE KETOGENIC DIET

The ketogenic diet is based on the theory that when the ratio of ingested fatty acid to glucose exceeds 2, ketone bodies circulate in the blood and produce a mild ketosis or acidosis (see discussion of the ketogenic-antiketogenic ratio), a sedation which exerts a beneficial effect in several clinical conditions. The first use of this type of diet was for the control of epilepsy.

Epilepsy, a condition rather than a true disease, has been described for many centuries. Ancient writers attributed it to evil spirits, and various attempts were made to drive them out. Although various theories have been advanced to explain the nervous mechanism involved in the precipitation of the attack or seizure, none is satisfactory. The suggestion that it is due to some sudden change, probably metabolic in origin, in the physicochemical relationship within the brain, has led to the attempt to control the attacks by dietary adjustment. However, no single specific change has ever been found at autopsy to be specifically associated with epilepsy.

In 1921 Geyelin called attention to the beneficial result which fasting exerted on epilepsy, and recognized the part which acidosis plays. In the same year Wilder suggested the use of the ketogenic diet as a more practical and equally satisfactory method of treatment. Since then a measure of success has been obtained by the use of these diets, especially in children.

Lennox and Cobb in 1928 stated that in certain epileptic persons, who were subject to frequent seizures, the attacks could be precipitated by lack of oxygen or by alkalosis, and conversely, these attacks could be prevented by increased oxygen intake and by ketosis. Obviously, it is not practical to maintain patients in a condition of controlled oxygen or carbon dioxide tension, but it is possible to control their state of ketogenic-antigenic balance.

McQuarrie later (in 1929) expressed the belief that the epileptic tended to retain water and that diuresis tended to postpone seizures, and suggested that water restriction was of added value. Ad-

ditional sedation by means of drugs is frequently advantageous and has come into general use.

Today the dietary treatment of epilepsy incorporates these ideas even though as yet the definite cause and effect are unknown.

The ketogenic diet is extremely difficult to ingest. It is unpalatable and frequently results in nausea and vomiting. Therefore, it is preferable to increase the fat slowly, rather than to place the patient on the drastically different diet immediately. The gradual increase in fat, and the decrease in carbohydrate, make possible eventually an FA:G of as high as 3:1 or 4:1 with a minimum of discomfort.

To calculate the ketogenic diet is simple, to fulfill the prescription is less easy. Since the ketogenic diet must be maintained over long periods, probably for life, the ketogenicity and low water intake must be the only factors of imbalance. The diet may be planned in a manner similar to that for the diet of the diabetic patient. (See Table 94.)

TABLE 94

Forty calories times the height of the patient in inches, or 35 calories per kilogram of weight, or the basal metabolic level plus 50%, or any method desired may be used for obtaining the caloric need.

Protein—Approximately 15% of the total calories (1.5 to 2 gm. per kilogram of body weight).

The fat—approximately 60 to 85% of the calories, and the carbohydrates the remaining 5 to 25%.

In fact the ketogenic diet is essentially the same high fat diet as was used for the control of diabetes before the discovery of insulin.

McQuarrie suggests that the total water intake be calculated as:

30-40 gm. per kilogram for the pre-school child.
20-30 gm. per kilogram for the child from 5 to 10 years.
15-25 gm. per kilogram for the child 10 years and over

If the sodium chloride is held at the minimum level for safety of 2 to 3 gm. daily, the possibility of water retention will be decreased.

Absolute adherence to the diet, except under certain conditions of drug therapy, is imperative if any degree of success is to be achieved. Minor adjustments may have to be made in order to

adapt the diet to the individual, but these should be few. An initial fast period is sometimes of value.

Discouragement must not be felt if no improvement is noticed within the first six months of dietary restriction. Long periods are sometimes necessary to bring about a noticeable effect. When the patient has been free from attack for several months under such a regime, there may be some relaxation in the ketogenicity of the ratio.

Lower protein levels are sometimes suggested than are here indicated, and McQuarrie calls attention to the dangers of this practice on the basis of two facts; first that ketosis enormously steps up the patient's protein requirement, and also that protein starvation tends to increase water storage, and thus defeats the attempt at dehydration. McQuarrie suggests that protein levels up to 2 gm. and over are more nearly adequate than that of 1 gm. and under.

The curtailment of carbohydrate in the form of cereals and cereal products, and the curtailment of milk because of its water and sugar content, bring about a deficiency of the B vitamins in the diet, and a commercial source of this complex must be used. Because of the curtailment of milk the diet is also deficient in calcium. This is a matter of importance in child patients, and their diets must include calcium supplementation. Cheese can partially replace milk, or for young children a milk substitute may be prepared by mixing 40% cream with 4% calcium caseinate in water, which has been sweetened to taste with saccharine.

Fruits and vegetables served as salads prevent loss of vitamins and minerals and also act as vehicles for large quantities of cream or mayonnaise dressings.

The fruits and vegetables must, of course, be low in carbohydrate, in the 5 and 10% groups (see Table 103).

Egg yolk is preferable to the whole egg and may be used as garnish, made into noodles by slowly adding it to rapidly boiling liquid and beating with a fork to break into shreds, or it may be scrambled with butter or cream.

Forty per cent cream should be used because it has a lower water and higher fat content than lighter cream.

Ice cream, custard, puddings made from cream, egg yolk, saccharine, and flavorings all may be eaten.

Diabetic gelatins may be prepared, using cream as the liquid.

Fat meats and dark-colored or oily fish should be used in preference to the leaner varieties. Liver should be included at least once weekly.

Gluten products, breads, cereals, muffins, cookies, etc., are justifiable on this type of diet. They are starch free, and since the fatty acid and glucose are approximately equal, they can become ketogenic by acting as carriers of butter, peanut butter, etc. In addition they make possible the inclusion of bread and cereal in the diet. Peanut butter may be creamed with dairy butter or mayonnaise and used as a spread, as may full cream cheese.

Calcium caseinate can be made into popovers or cream puffs which act as carriers of butter and cream as well as calcium.

Agar, well-washed bran, thrice-cooked vegetables, and diabetic gelatin give bulk to the diet and increase its satiety value.

TABLE 95

With the foregoing suggestions and the following dietary outline, a diet of approximately 2,000 calories having a FA : G ratio of 3:1 may be planned for each day.

¾ cup 40% cream
½ cup starch-free cereal
1 small orange
1½ cup 5% vegetable
4 ounces meat
4 strips bacon (4½ by 1 by ⅛ inches)
1 serving starch-free cereal product (Lister or Cellu)
⅔ ounce full cream cheese
2 eggs
3 tablespoons butter
Cod-liver oil
Vitamin B complex product
Calcium supplement

Such a diet outline would yield approximately 12% of calories from protein, 83% from fat, and 5% from carbohydrate (63 gm. of protein, 196 gm. of fat, 26 gm. of carbohydrate). By referring to the "interchanges" suggested in the Appendix, variations in menu planning may be made without deviating from the final ratio between the foodstuffs. Such a diet level would be suitable

for a person weighing approximately 45 to 50 kilograms. It might be distributed through the day as:

Morning	*Noon*	*Night*
Cereal with cream	Creamed meat	Cream soup
Fruit	2 vegetables	Meat
Bacon and egg	Gelatin with cream	Vegetable salad
		Starch-free crackers and cheese

The ketogenic diet is also used in the treatment of migraine and for infections of the urinary tract.

Review Questions

What theory is the basis for the ketogenic diet?

For what conditions is this diet sometimes used?

In addition to the ketogenic diet, what other means are used to prevent seizures in the epileptic?

What adjustments from the normal are made in the food nutrients in the ketogenic diet prescription?

What range of percentage of the total calories may be given as protein? What range for fat? Carbohydrate?

What ratio of FA: G may safely be used?

Is it advisable to make the change to the high fat diet suddenly?

What are the indications in regard to water and salt in conjunction with the diet?

Are favorable results from the use of the diet to be expected quickly?

What foods are used in filling a ketogenic prescription?

Are supplemental vitamins necessary?

CHAPTER XLII

FOOD ALLERGY

There is nothing new about allergy except the name itself, which indicates altered reactions or abnormal response. Certain individuals, for some unknown reason, are hypersensitive to certain substances. Such people break out in a rash, develop hives, sneeze, suffer from asthmatic attacks, severe headaches, ringing and pressure in the ears, or are afflicted with flatulence, cramps, nausea, diarrhea, or vomiting. Why? Scientists wish they knew. Apparently abnormal cell reaction of some kind is the cause. If the irritable cells are in the nose, sneezing develops; if in the throat, coughing results; if in the stomach, nausea, cramps, and even vomiting, may follow; and if in the lungs, wheezing or asthma occurs.

While any one of the symptoms may result from contact with the offending substance, there is a tendency for certain substances to cause reactions in somewhat localized areas; for instance, asthma or respiratory tract irritation usually results from the pollens, dust, feathers, or from the dairy products. Wheat and other cereals are frequently the causative agent for migraine (a specific type of headache). Milk, eggs, cereals, and pork should be suspected first in skin rash. Strawberries, tomatoes, chocolate, and fish are the most frequent cause of hives. Food allergies must not be confused with food poisoning (see Chapter XV) or with dermatologic conditions.

Unfortunately, allergy has been exploited to such an extent that it has become in many instances a fad resulting in dietary maladjustment. There are undoubtedly many unrecognized food sensitivities existing that cause preventable ill health. When the sensitivity is real, it is of great importance that dietary adjustment be made, but it is of equal importance that the diet be so planned that deficiencies do not result. Careful substitution is necessary, and padding with commercial products may be imperative. Diets for allergic conditions should always be supervised by someone trained to recognize nutritional needs, who understands biological relationships of foods, and who can ferret out minor causative factors that may be obscure to the casual

observer. In allergy the fault lies in the body cells, not in the food. The offending material may be one or more of a vast number.

Eyermann has listed, in Table 96, the frequency with which foodstuffs induced symptoms of nasal allergy in his series of 181 cases.

Although an allergic attack may be caused by food, house dust, feather pillows, the horse, dog, or cat, some garden plants and weeds, a brand of face powder, and other things, only food allergy will be discussed here.

Fig. 85.—Infantile eczema in a child sensitive to milk and eggs. (From Sutton and Sutton: *An Introduction to Dermatology*, The C. V. Mosby Co.)

Treatment in all types of allergy is essentially the same, namely, desensitization or the avoidance of the offending substances. There is no real difference between the various types of allergic reactions. Fundamentally they are all manifestations of the same abnormal condition of hypersensitivity. Symptoms may be mild or severe;

they may occur almost at once or they may be delayed from half an hour to several days. The longer time complicates the picture and obscures the cause.

While food allergy generally results from the ingestion of the food, the mere handling of it may precipitate an attack, and unbelievably minute traces may cause an attack in a highly sensitive person. The meat of the hen has been reported as bringing on an allergic attack in a person sensitive to egg, whereas the same individual could eat rooster meat with impunity. Or an attack may result only when large amounts of an offending material are ingested. The strange forms in which the sensitivity manifests itself may at times be very misleading. All these factors tend to make

TABLE 96

FOODS FREQUENTLY CAUSING ALLERGIC SYMPTOMS ARRANGED IN ORDER OF FREQUENCY

FOOD	FREQUENCY	FOOD	FREQUENCY
Wheat	61	Grapefruit	3
Chocolate	44	Pineapple	3
Egg	35	Ginger	3
Milk	26	Lettuce	3
Beans	21	Mint	3
Peas	18	Oats	3
Potato	17	Lamb	3
Tomato	16	Spices	3
Corn	16	Cinnamon	3
Beef	15	Carrot	3
Onion	15	Strawberry	2
Pork	13	Sweet potato	2
Fish	13	Cucumber	2
Nuts	10	Cherry	2
Cantaloupe	9	Cheese	2
Peanut	8	Cauliflower	2
Black pepper	8	Cocoanut	2
Chicken	6	Green pepper	2
Asparagus	6	Tea	1
Orange	5	Raspberry	1
Apple	4	Blackberry	1
Grape	4	Cloves	1
Cabbage	4	Garlic	1
Rice	4	Rye	1
Liquor	4	Veal	1
Peach	3	Mustard	1
Spinach	3	Celery	1
Almonds	3	Plum	1
Watermelon	3	Lemon	1

From Eyermann: *Food Allergy as a Cause of Vasomotor Rhinitis.* South. M. J. 31: 210, 1938 Reproduced from Hawley-Maurer-Mast: *The Fundamentals of Nutrition,* Charles C Thomas.

allergy a fascinating study, but one requiring ingenuity and intelligent cooperation from the patient.

Allergy frequently occurs in more than one member of a family or in succeeding generations. The tendency to be sensitive is not always transmitted with the symptoms in the same form, nor does the same form always exist in the same person throughout life. A child may exhibit eczema in infancy and apparently outgrow it, and suffer later from asthma for some years, only to have this yield to gastrointestinal symptoms.

Diagnosis is difficult. Several methods, in addition to careful history, are suggested. Food extracts are injected into the superficial layers of the skin in the skin test. In the scratch test a drop of the food extract is placed on a scratch made on either the arm or the back. A positive reaction following the contact between body cells and the prepared allergens (the extracts of suspected substances) may help to implicate an offending substance. These tests are not infallible, but may be indicative. The positive test consists in the development of an urticarial wheal or raised area surrounded by an erythematous or reddened zone. The "leucopenic index" is also sometimes used. This is based on the assumption that following digestion of a food to which the patient is sensitive, the total leucocyte count in the blood usually falls. It is probable that the only reliable method for detecting the causative agent is through a carefully kept diary of the food eaten, activities, and environment. This, if sufficiently complete with comments on personal physical reactions to give a fair history of the patient, and used with elimination diets, may enable the doctor to discover the cause of the reaction. It may be a combination of circumstances or foods or an additive effect of several factors, each causing reactions too mild to arouse suspicion. A history of previous health and family ailments may furnish the clue. The history outline suggested by Tuft in his *Clinical Allergy* is well worth reading.

Treatment of allergy is aimed toward the removal of the causative agent. Diets designed to eliminate specific foods are known as elimination diets. They consist of carefully worked-out food combinations based on the premise that if an individual is sensitive to a given food, he will undoubtedly react similarly to other foods belonging to the same biological family. Rowe, the pioneer in this

method of treatment, has worked out four diets which bear his name and are known as Nos. 1, 2, 3, 4. Each diet eliminates certain foods or food groups and emphasizes others.

By following a diet for a period of days it is possible to ascertain whether the foods contained in the diet, or eliminated from the diet, are responsible for the attacks. Unfortunately, milk, eggs, wheat, and potatoes, especially the first three, are the chief

TABLE 97

ELIMINATION DIETS

DIET 1	DIET 2	DIET 3	DIET 4
Rice Tapioca	Corn Rye	Tapioca White and sweet potato	Milk*
Rice biscuit Rice bread	Corn pone Corn rye muffin Rye bread Rye crisp	Lima bean-potato bread Soya bean-lima bean bread	
Lettuce Spinach Carrot Beet Artichoke	Tomato Squash Asparagus Peas String beans	Beets Carrots Lima beans String beans Tomato	
Lamb	Chicken Bacon	Beef Bacon	
Lemon Grapefruit Pears	Pineapple Peaches Apricot Prunes	Lemon Grapefruit Peaches Apricot	
Cane sugar Wesson oil Olive oil Salt Gelatin Syrup made of maple sugar or cane sugar flavored with mapleine or maple sugar Olives Pear butter	Cane sugar Mazola oil Wesson oil Salt Karo corn syrup Gelatin	Cane sugar Olive oil Wesson oil Gelatin Salt Olives Maple syrup or syrup made with cane sugar flavored with maple	

*Milk should be taken up to two or three quarts a day. Tapioca cooked with milk and milk sugar also may be taken.

Note.—Wesson (cottonseed) oil is included in all diets. With allergy to cottonseed as shown by skin test or history this must be excluded and a cottonseed oil shortening, such as Crisco, must not be used. If allergy to cane sugar is suspected, beet sugar or corn glucose may be used. (Copied from Vaughan: *The Practice of Allergy*. The C. V. Mosby Co. See Appendix for additional suggestions.)

offenders. A milkless, wheatless, eggless diet will alleviate the symptoms if one of these foods is the offender. After a few symptomless days, the cautious addition of first one and then another of these foods will indicate, perhaps, that only one is the offender. If so, that food must be eliminated from the diet in every form. If eggs, not only eggs as such, but cakes, pies, puddings made with eggs. Noodles and baking powder, if made with eggs, must be avoided. *One must know the ingredients used in prepared foods.* (See appendix for list of foods and possible allergens they contain.)

Alvarez begins even more cautiously in his treatment. The first diet consists only of lamb, rice, butter, sugar, canned pears, or gelatin. These, experience has taught him, are less liable to cause reactions than other foods. No pepper, sauces, cream, or drink of any kind except water, is allowed. If no reaction results during the ingestion of this diet (a food diary is kept), other foods are slowly added: potato, cream, asparagus, carrots, string beans, oatmeal, and dextrinized bread, over a period of two weeks. With sufficient time interval between additions, it is possible to determine tolerance for each food. Milk, eggs, plain bread, and other foods then may be added in turn. (See appendix for botanical grouping of foods.)

When the offending food is finally isolated, a new set of recipes must be followed, and vigilance must be maintained to prevent the ingestion of the food in some unsuspected form. Fortunately, many food manufacturers are stating accurately on food packages the constituents making up the food. A number of milkless, eggless, wheatless suggestions and recipes are available (see Appendix) and with careful planning a fairly normal diet may be obtained for the victim of allergy, even though the sensitivities are several. When the allergy occurs in a child, it is especially important that commercial vitamins or mineral products be employed as supplementation to the diet, unless the diet adequately provides them.

Frequently heating a food will alter its structure favorably. Many children who cannot drink raw, pasteurized, or dried milk, can take boiled milk or evaporated milk. A person sensitive to corn may take corn syrup. Prolonged cooking or toasting of cereals and cereal products sometimes renders them nonreactive where the usually prepared cereal would be.

A statement by Vaughan will serve as a summary: "The most successful therapeutic program in food allergy consists in (a)

searching for and finding the offending allergens, (b) their elimination from the diet, (c) the providing of an adequate dietary program with substitute foods, (d) food additions as rapidly as the patient's tolerance will permit. When avoidance is impossible, desensitization either orally or parenterally may be attempted, although this method is usually not as successful. There is evidence that the natural tendency is toward loss of sensitization provided the tissue response is not repeatedly restimulated by recurrent exposure to the allergen. After sensitization has been lost, following avoidance, the patient often finds that he can again eat the offending food in moderation."

Review Questions

What does the term allergy mean?
What are some of the symptoms of allergy?
Does food allergy indicate food poisoning?
What two treatments are used for allergy?
Is food allergy always caused by the ingestion of the offending food?
Is allergy an inherited characteristic? Explain.
What methods are used to diagnose an allergy?
What is the purpose of the Rowe elimination diets?
What diet regime is used by Alvarez?
What foods most frequently cause allergies?
How does Vaughn summarize a successful therapeutic program in food allergy?
Does a hypersensitive person remain so through life?

CHAPTER XLIII

LEAD POISONING

One of the industrial hazards is the absorption by the body over a period of time of various metals which in minute traces cause no disturbance, but which from steady accumulation can result in toxic symptoms. Lead is such a metal, and lead poisoning is not uncommon, particularly among painters.

Lead is absorbed through the lungs, the skin, and the gastrointestinal tract, and is carried in the blood stream to all parts of the body. In passing, it exerts a toxic effect upon the nervous system with sometimes severe neurologic complications. Some of the lead is deposited in the bones, some is excreted by the intestines, and some through the kidneys. The fact that it is deposited in the bones in an inactive form gives the basis for dietary treatment in the alleviation of the condition.

Treatment is carried out in two stages. The first or acute stage of the attack is characterized by colic, weakness, constipation, headache, anorexia, weight loss, and progressively increasing inability to grasp articles with the hands or to raise the hands to an angle above the wrists. Here treatment is directed toward withdrawal of lead from the blood stream and its immobilization in the bones. When the acute attack is over, the lead is slowly released from the bones and is gradually and steadily eliminated from the body. These two actions are carried out by diet adjustment.

Lead acts much like calcium, and the factors which lead to calcium deposition in the bones will likewise result in lead deposition, namely, adequate intake of calcium and phosphorus, an optimal ratio between the two, and an adequate supply of vitamins C and D. The deposition of lead, therefore, is brought about by administering a high calcium, phosphorus, and vitamins C and D intake. In the acute stage the daily diet should contain milk in the amount of 3 quarts or more, generous amounts of cheese, eggs, vegetables, fruits, and fruit juices. Vitamin D should be supplied by a commercial product since the diet itself will not supply enough. One thousand units will probably be adequate. Fat in

excess should be avoided in order to prevent calcium loss from the stools as calcium salts.

After the acute symptoms have subsided, calcium, phosphorus, and vitamin content of the diet are gradually lowered, a procedure which simultaneously results in withdrawal of the lead deposits from the bones. The diet should at this stage omit the large quantity of milk used in "fixing" the lead, and may now contain cereals, meats, fats, etc. Aub believes that an acid ash diet is conducive to the deleading process. Conversely, the alkaline ash diet of the acute episode should favor deposition.

Review Question

What is the process of de-leading a patient suffering from lead poisoning?

CHAPTER XLIV

ARTHRITIS

The dietary adjustments suggested for joint disorders have been many. On the mistaken assumption that fruits and vegetables are acid, and that acidosis is the cause of "rheumatism," diets low in, or devoid of, fruits and vegetables have been used. The fallacy is that fruits and vegetables leave an alkaline ash and actually counteract acidity. The elimination of these foods results in vitamin and mineral deficiencies. Protein has been restricted on the belief that all types of arthritis are gouty. Drastic restriction of protein is decidedly dangerous. Food allergy has been suggested as a cause, and may be in some cases, but restriction of diet with the idea that certain foods are causative factors has little foundation. Recently carbohydrates have been given critical consideration, and there are those who claim improvement as the result of low carbohydrate intake. The Pemberton diet has had great vogue. However, the delayed sugar removal which the low carbohydrate diet is designed to combat, is held by most authorities to have little significance, and the Pemberton diet is less widely used than it was formerly.

High content of vitamins B_1, C, and D have all come in for their share of interest. Vitamin B_1 is concerned with improvement of carbohydrate utilization. Vitamin C is concerned with joint health. A characteristic of scurvy is the swollen, sore painful, and hemorrhagic joint, and a low ascorbic acid level of the blood is found in these patients. Vitamin D is important for its action in mineral metabolism. Massive doses of vitamin D have been given in arthritis, but the general opinion seems to be that this treatment is ineffective. Serious reactions have been reported as the result of massive vitamin D dosage.

What then is the diet best for patients with arthritis? It is probably a diet high enough in calories to maintain the patient at low normal weight level. Obesity puts additional and unnecessary strain on joints that are already tender. The diet should contain generous protein (around 100 gm.) and carbohydrate which is not excessive. Sweets, rich desserts, and highly starchy

foods have no virtue when weight is to be controlled. Adequate vitamin and mineral intake is important. Generous amounts of fruits and vegetables should be used, and a fish oil preparation should be supplied as a source of vitamin D.

Such a diet takes cognizance of the recent theories underlying the dietary treatment of arthritis and combines them into a well-balanced diet. Adjustment in bulk content can easily be made whenever necessary. The diet may be liquid, soft, smooth, or high in roughage. In making adjustments care should be taken to maintain adequacy. The vitamin B complex, especially vitamin B_1, and vitamin C should be added if they are not supplied in sufficient amount in the foods chosen. To date there is no specific "antirheumatic" vitamin or hormone or specific dietary treatment as a recent review* points out.

The increasing incidence of arthritis as an economic as well as a humanitarian problem has resulted recently in an active research program to determine its cause, control, and cure. One may hope for more definite data in the near future.

Review Questions

What, at the present time, is considered the best diet for patients with arthritis?

Upon what theory is this diet based?

*Nutr. Rev. 7: 33, 1949.

CHAPTER XLV

THE DIET OF SURGICAL PATIENTS

In considering the dietary adjustments which should be made in the feeding of the surgical patient, it must be realized that no set rules can be laid down. Obviously, the type of surgery, the possible complicating clinical conditions such as diabetes, nephritis, and the general state of nutrition, are all influencing factors. The operation may be minor, the patient may be in excellent health and his probable convalescence may be short, or the individual may have suffered from his ailment over a period of weeks or months, and may be in a state of extreme undernutrition and other disease conditions may complicate. The diet offered will be adjusted to the conditions present; in general, it should be high in protein, carbohydrate, and vitamins.

Certain generalizations may, however, be made. Good nutrition is an asset, and every effort should be made to preserve or attain this condition. The administration of an anesthetic is always accompanied by fluid loss and gastrointestinal disturbance, and both the anesthetic and the anticipation of an operation are apt to bring about psychic disturbances in varying degree which may be reflected in digestive disturbances. The degree of reaction may differ widely in various patients, even though their general state of health may appear similar. This variation prohibits exact routine procedure and makes personalization of treatment necessary.

The preoperative treatment in general use today predisposes to more rapid recovery than did the older method. Drastic purging once depleted the body of water just at the time when maximum storage was desirable. Withholding of food or a "light" diet likewise depleted the carbohydrate stores when they should have been at maximum. Today, unless there are complicating factors, the preoperative diet need not be restricted, except in bulk content. If bulk is kept low for the last thirty-six hours before operation, the fecal bulk will be reduced to a minimum at time of operation, a condition resulting in the same general effect as the preoperative cathartic. Fluid intake and carbohydrate should be as high as can be tolerated comfortably. Carbohydrate has

a protective action in combating the toxic effect of anesthesia. Dr. McLester suggests that one of the best preoperative precautions is to provide a pitcher of water and a box of candy. Food should, if possible, be withheld sufficiently long to assure an empty stomach at the time the anesthetic is administered. The usual procedure is no food after the evening meal for an operation scheduled the following morning. If the operation is delayed until afternoon, a fluid breakfast is usually desirable.

The practice of hypodermoclysis begun before the patient recovers from the anesthetic has been a great boon from the standpoint of later comfort, and also speed of recovery. Should the patient be in a state of undernutrition, however, supplying both liquid and glucose (supported by B vitamins) by parenteral routes as preoperative measures, rather than the postoperative hypodermoclysis, has proved more advantageous.

In the uncomplicated operation, in which the gastrointestinal tract is not involved, the patient can rapidly be returned to light palatable diet. Food need be withheld no longer than for the period of nausea and vomiting, the first twenty-four, or possibly thirty-six, hours. During this time water or carbonated drinks may be offered, but not forced. The extent to which a patient reacts to the entire situation, and the time elapsing before intestinal paralysis is overcome, must govern food intake. Usually, when the patient expresses a desire for food or for a special food, he has reached the point where it may be tolerated.

Frequently a debilitating sickness has preceded the surgical intervention. This will necessitate careful preoperative preparation of the patient if he is to withstand the shock of operation and to make optimum recovery. The diet should be carefully adjusted in the preparatory period so as to be high in protein, minerals, and vitamins—a palatable, easily digested, concentrated diet, directed toward maximum nutritional response. Anemia may complicate the condition and should receive specific consideration (see discussion of The Anemias).

If adjustment is necessary to meet specific conditions, such as diabetes or nephritis, careful planning will be required to avoid deficiencies.

If the gastrointestinal tract is involved, the postoperative diet must subscribe to the dysfunction. Gastrointestinal activity is then highly undesirable, and rest is imperative. In spite of the

wish to re-establish normal dietary routine as quickly as possible, it is wiser to sacrifice nutrition in these patients for the sake of the local lesion. It may be necessary to withhold food for from forty-eight hours to as long as ten days. During this period nothing may be given by mouth; however, vitamins, glucose, protein, fat, and fluids may be administered by hypodermoclysis, nutrient enemas (proctoclysis), or by the intravenous route (see Chapter XXVII). The time that elapses between operation and ingestion of food depends on the site and severity of the lesion. An operation for removal of appendix or gall bladder may require abstinence from food for only thirty-six to forty-eight hours; whereas operations on the stomach, intestine, or colon require much longer abstinence. Diet is resumed with strained fruit juices, ginger ale, broths, etc.; followed by liquid, soft, and convalescent diets. Gas formation, roughage, foods difficult to digest or irritating in any way, are to be avoided. It may be a month or several months before the patient may resume his usual diet. Maximum nourishment with minimum effort is the aim of the diet.

Review Questions

What is the modern method of dieting the preoperative patient?

What food nutrients should be at a high level at the time of operation?

What diet is served to the patient after an uncomplicated operation?

What is the procedure after an operation involving the gastrointestinal tract?

CHAPTER XLVI

SUBCLINICAL DEFICIENCIES

The true deficiency diseases have been discussed in Chapter XI. These conditions, as described and illustrated, may not be frequently seen at such an advanced stage, but subclinical symptoms or conditions, which can readily be visualized as forerunners of these more advanced clinical pictures, are not uncommon. Many vague symptoms characterized by indigestion, joint pains, fatigue, mild skin disorders, sore mouth, etc., can many times be shown to be subclinical deficiencies of vitamins or some other food constituent. The term subclinical is used to indicate that the complete picture of the deficiency is not present at the moment, but is potentially so, and it may be precipitated suddenly by some stress or strain (overfatigue, infection, pregnancy, etc.) or by a longer time interval itself. These symptoms frequently confuse the clinical picture, and are added reasons for obtaining a complete dietary history.

These mild or subclinical deficiencies are of greater importance in medicine than the true deficiencies, and they deserve greater consideration. (See Chapter XIX.)

A comprehensive and concise discussion on "Influencing Factors in Nutritional Deficiency Disease" has been published in the *American Journal of Digestive Diseases and Nutrition* for February, 1937, by Dr. Russell Haden of the Cleveland Clinic. It expresses so clearly facts which we wish to emphasize, that we are glad to have Dr. Haden's permission to abstract it here.

A nutritional deficiency is due to an inadequate supply or absorption or utilization of vitamins, minerals, or other nutritional factors formed in the body from food. That true vitamin deficiency diseases occur in the absence of, or inadequate intake of, these substances has been recognized for some years, but only recently has medical science appreciated that a lack of *any* necessary nutritional factor may play an important part in producing symptoms occurring in many diseases, or may explain symptoms for which there has heretofore been no adequate explanation. Haden refers to the work of Mackie on the relationship between

deficiency and chronic ulcerative colitis, and of Weiss on the occurrence of cardiac symptoms when vitamin B is inadequate. He points out that a deficiency disease is due to the non use of a specific food factor at the site in the body where it is needed and would normally be utilized. The factor, while it cannot be used if not present, may be present but not used. Incorporation of a nutritional factor into body substance or function necessitates three conditions: its presence, its absorption, and its adequate utilization. Haden used for example the need for the erythrocyte-maturing factor, normally formed in the stomach by the action of the intrinsic factor secreted by the gastric glands on the extrinsic factor taken in with food (see The Anemias). In idiopathic pernicious anemia there is a defect in supply, since the stomach fails to form the intrinsic factor. In sprue the factor is formed, but it is lost in the diarrhea. In myxedema the factor may reach the marrow and not be utilized. In each of these three conditions the bone marrow reacts in the same way and a macrocytic anemia results.

The factors influencing the supply, absorption, and utilization of food constituents should be evaluated as to their possible relation to disease.

Recently Jolliffe has clearly and concisely summarized conditioned malnutrition as indicated by the quotation which follows including Tables 98 and 99.

> Conditioned malnutrition symptoms may be caused by factors which interfere with the ingestion, absorption or utilization of essential nutrients, or by factors that increase their requirement, destruction or excretion. In nutritional surveys there has been a tendency to neglect the causal role of such conditioning factors and attribute malnutrition to dietary inadequacies alone.
>
> Several so-called "conditioning factors" regularly interfere with proper utilization of many essential nutrients. A tabular summary of "Gross Evidences of Malnutrition" and "Special Examinations for Detection of Malnutrition" are shown (Table 98) followed by a listing of such factors in tabular form (Table 99).

Disease is a chemical problem in which all possible influencing factors in its development must be considered. Whenever a deficiency is suspected of being a possible factor in the patient's symptoms, the absorption and use of the nutritional elements,

TABLE 98

Gross Evidences of Malnutrition

SYSTEM	FINDING	SUGGESTED DEFICIENCY OR SYNDROME
Eyes	Xerosis conjunctivae and corneae	Vitamin A
	Central ophthalmoplegia	Thiamine
Mucous membranes	Scarlet red stomatitis and glossitis with or without secondary Vincent's infection	Nicotinic acid
	Magenta glossitis	Riboflavin
	Atrophic glossitis	Nicotinic acid, B complex, Addisonian anemia, Plummer-Vincent syndrome
	Scorbutic gums	Ascorbic acid
	Cheilosis	Riboflavin
	Nonspecific urethritis, balanitis, vaginitis	Nicotinic acid
Skin	Pellagrous dermatitis	Nicotinic acid
	Seborrheic lesions in nasolabial folds on face, behind ears and in skin folds	Riboflavin
	Hyperkeratosis and hyperfolliculosis	Vitamin A
	Hemorrhagic manifestations	Vitamin K, ascorbic acid
	Fissures in angles of mouth	Riboflavin
Neurologic	Characteristic bilateral symmetrical polyneuropathy	Thiamine
	Combined system syndromes	Thiamine, B complex, Addisonian anemia
	Wernicke's syndrome	Thiamine, B complex
	Nicotinic acid deficiency encephalopathy	Nicotinic acid
	Progressive stupor and hebetude	Nicotinic acid
	Certain organic reaction psychoses	Nicotinic acid, thiamine, and B complex
Skeletal	Rachitic deformities and osteomalacia	Vitamin D, calcium, phosphorus
General	Underweight, underheight, edema, pallor	Calories, proteins, iron, B complex

TABLE 98—CONT'D

Special Examinations for Detection of Malnutrition

EXAMINATION	CONDITION IT MAY DETECT
Roentgenogram of hand and wrist, elbow and hip	Rickets and scurvy in children; osteomalacia and scurvy in adults
Roentgenogram of heart	Advanced beriberi
Electrocardiogram	Changes suggestive of thiamine deficiency
Biomacroscopic eye examination with slit lamp	Capillary invasion of cornea (riboflavin deficiency); changes in conjunctivas (vitamin A deficiency)
Red blood cell count Hemoglobin Stained blood smear Red blood cell volume	Iron deficiency anemia; Addisonian anemia; macrocytic anemia
Plasma ascorbic acid	Vitamin C undersaturation
Serum calcium Serum phosphatase Serum phosphorus	Vitamin D deficiency
Blood pyruvic acid	Vitamin B_1 deficiency
Serum protein or albumin	Protein deficiency
Blood prothrombin	Vitamin K deficiency

Reproduced from Nutritional Charts, H. J. Heinz Co., summarized from N. Jolliffe: J. A. M. A. 122: 299-306, 1943, by whose permission it is used here.

TABLE 99

Factors Interfering With Ingestion

1. Gastrointestinal disorders
   Acute gastroenteritis, gall-bladder disease, peptic ulcers, diarrheal diseases and obstructive lesions of gastrointestinal tract
2. Neuropsychiatric disorders
   Neurasthenia, neurosis, psychoneurosis, psychoses, migraine, and neurologic disorders interfering with self-feeding
3. Anorexia
   Alcohol, operations, anesthesia, infectious diseases, congestive heart failure, thiamine deficiency, visceral pain
4. Food allergy
5. Loss of teeth
6. Pregnancy
7. Therapy
   Diets restricting ingestion of essential foods

Factors Increasing Nutritive Requirement

1. Abnormal activity, associated with prolonged strenuous physical exertion, delirium, and certain psychoses
2. Abnormal environmental factors
   Excessively high temperatures, as in the tropics, in deserts and in certain industries
   Excessive light glare as from snow or kleig lights
3. Fever
4. Hyperthyroidism
5. Pregnancy and lactation
6. Therapy such as thyroid, alpha-dinitrophenol, parenteral dextrose solutions, fever therapy, high carbohydrate diets

Factors Interfering With Absorption

1. Gastrointestinal diseases associated with hypermotility or reduction of absorbing surfaces
2. Achlorhydria
3. Biliary disease, especially obstructive jaundice
4. Vitamin deficiency
5. Therapy
   Liquid petrolatum, colloidal adsorbents, severe catharsis, gastric or intestinal resections and short circuiting operations

Factors Interfering With Utilization

1. Hepatic dysfunction, as in liver disease, diabetes mellitus, alcoholism
2. Hypothyroidism
3. Malignancy
4. Therapy
   Sulfonamide drugs, radiation therapy, phenytoin

Factors Increasing Excretion

1. Polyuria, as in diabetes mellitus, diabetes insipidus
2. Lactation
3. Excessive perspiration
4. Therapy
   Long continued excessive fluid intake, as in urinary tract infections

Factors Increasing Destruction

1. Achlorhydria
2. Lead poisoning? trinitrotoluene poisoning?
3. Therapy
   Alkalis, sulfonamides, arsenicals

Reproduced from Nutritional Charts, H. J. Heinz Co., summarized from N. Jolliffe: J. A. M. A. 122: 299-306, 1943, by whose permission it is used here.

and their quantitative intake should be evaluated. It is especially necessary to recognize the importance of the summation of several conditioning factors. Adequate dietary intake, or adjustment to meet specific needs, is probably of wider importance than is at present recognized.

Review Questions

What is a nutritional deficiency?

What are some of the causes of nutritional deficiencies other than an inadequate intake of any or all of the food nutrients?

CHAPTER XLVII

SUMMARY OF DIET THERAPY

It is hoped that the foregoing pages have re-emphasized the original premise stated—that the *diet in any clinical condition should and can be made by adjustments in the normal diet pattern;* that the body as a whole is more important than any individual part and it must not be sacrificed for any one dysfunction. A midcourse is frequently necessary for this end—concessions to total body needs. For assurance of adequacy of a therapeutic diet, the final diet should be checked against the accepted standard requirements.

In Table 100 there is an outline indicating variations from the normal, and in Table 101 these data are further summarized. Also see Table 38 for review of normal recommended allowances.

TABLE 100

NORMAL CONSTITUENTS AND VARIATIONS FROM THE NORMAL CONSTITUENTS OF THE DIET (ADULT)

Calories:	35 to 100 calories per kilogram per 24 hours depending upon age and activity, or the height in inches times 40 calories per inch. *Increased* in malnutrition, end of pregnancy, fevers, when metabolic rate is elevated. *Decreased* in obesity, diabetes, hypertension, gout, arthritis, hypothyroidism.
Protein:	1 to 1.5 gm. per kilogram for adult—10 to 15% of total calories, 2 to 3 gm. per kilogram for growing child. *Increased* in pregnancy, lactation, recovery from illness, malnutrition, when albuminuria is present and when serum proteins are low (nephrosis), in colitis, liver disease, typhoid, gastrointestinal tract disturbances, especially peptic ulcer and ulcerative colitis. *Decreased* in acute nephritis and uremia, moderate intake (as with all food) in cardiac disease or hypertension. In gout the diet should be purine free, therefore restriction of certain proteins (nucleoproteins).
Fat:	1 to 2 gm. per kilogram of body weight, 25 to 40% of total calories, a total of 75 to 150 gm. *Increased* in diabetes, hypoglycemia, epilepsy, malnutrition, constipation, tuberculosis, urinary tract infections, and in most high caloric diets. *Decreased* in certain liver disturbances, celiac disease, steatorrhea, pancreatitis, anemia, decreased gastric motility.

TABLE 100—CONT'D

Carbohydrate:	4 to 5 gm. per kilogram of body weight, 40 to 50% of the total calories. A total of 300 to 400 gm. *Increased* in liver and gall bladder disease, cardiac disease, acute nephritis and uremia, all fevers except tuberculosis, nausea and vomiting, high caloric diets, to overcome intestinal putrefaction. *Decreased* in diabetes, hypoglycemia, epilepsy or in the ketogenic diet, in tuberculosis.
Vitamins:*	A—5,000 to 8,000 I.U. daily. B_1—330 to 560 I.U. daily, 1 to 1.7 mg. B_2—600 to 1,200 S.B. units daily, 1.5 to 3 mg. Nicotinic acid 11 to 20 mg. daily. C—70 to 100 mg., 1,000 to 2,000 I.U. daily. D—400 I.U. E, K and other members of the B complex—requirement unknown. Specific vitamin therapy in the deficiency or subclinical conditions due to their lack. *Increased* general vitamin therapy in pregnancy, lactation, fevers or other conditions of metabolic increase, gastrointestinal disorders or lesions.
Minerals:	Ca 1 to 2 gm. P 1 to 1½ gm. Fe 12 to 15 mg. *Increased* in pregnancy and lactation, growth, and anemia. Alteration in intake of Na and K in Addison's disease. *Decrease* in K, and increase in Na in Addison's disease restriction of NaCl from usual 10 to 20 gm. to maintenance level of 2 to 3 gm. in edema. Acid-base balance shift to combat urolithiasis or urinary tract infection.
Water:	1 to 2 liters daily. *Increased* in fevers, certain kidney disorders, dehydration, Addison's disease, constipation. *Decreased* in edema, renal insufficiency, epilepsy.
Roughage:	*Increased* in atonic constipation and obesity. *Decreased* to produce smooth or soft diet, for gastrointestinal lesions, spastic constipation, malnutrition, high caloric diets.
FA:G	Normal ratio 0.8:1, diabetes 1:1, borderline 1.5:1, ketogenic level 3:1.
Acid-base balance:	The normal diet is neutral or somewhat alkaline. The *acidic* diet is used to facilitate the solution of phosphates while the basic or *alkaline ash* diet is effective when urates, oxalates, or cystine tend to precipitate. Adjustments may also be of value in combating infections.

*Refer to Table 38 for details of 1948 revision.

TABLE 101 A

SUMMARY OF ADJUSTMENTS OF THE NORMAL DIET TO MEET THERAPEUTIC NEEDS

1	2	3	4	5	6	7	8
NORMAL DIET	LOW SALT* NO SALT ADDED TO FOOD	LOW PURINE	SMOOTH**	BULKY	DIABETIC	ANEMIA	HIGH PROTEIN AND VITAMIN, LOW CARBOHYDRATE AND FAT
BREAKFAST							
Fruit	Fruit	Fruit	Fruit pulp or fruit juices	Fruit with pulp or skin	Fruit without sugar	Fruit, especially prunes and apricots	Fruit
Whole grain cereal with sugar and cream or milk	Cereal	Cereal, refined or enriched	Fine or strained cereal	Coarse cereal	Cereal	Cereal	Dry cereal (with banana)
Egg and/or bacon†	Egg†	Egg†	Egg†	Egg and/or bacon†	Egg†	Egg†	
Toast or muffins (enriched)	Toast or muffins (enriched)	Toast or muffins (enriched)	Toast or muffins (enriched)	Whole grain toast or muffins	1 slice toast (enriched)	Whole grain toast or muffins	Thin slice toast
Butter	"Fresh" butter	Butter	Butter	Butter	Butter	Butter	
Marmalade or jam	Marmalade or jam	Marmalade or jam	Jelly	Marmalade or jam			
Coffee† with milk or cream and sugar	Coffee† with milk or cream and sugar	Coffee† with milk or cream and sugar	Coffee† with milk or cream and sugar	Coffee† with milk or cream and sugar	Coffee† (with milk or cream)	Coffee† with milk or cream and sugar	Skim milk
LUNCHEON							
Soup	Cream soup	Cream soup	Cream soup	Soup	Clear soup†	Soup	"Cream" soup (skim milk base)
Entree and/or salad Salad dressing	Entree and/or salad without salt Salad dressing	Entree and/or salad without meat or fish Salad dressing	Egg, cheese, rice, or Italian paste entree	Entree and salad Salad dressing	Egg, meat, fish, cheese and salad Salad dressing	Entree and salad Salad dressing	Lean meat, fish, or ct. cheese and/or salad, cooked dressing
Bread or rolls† (whole grain or enriched)	Bread or rolls†	Bread or rolls† (enriched)	White bread† (enriched)	Whole grain bread†	Bread	Whole wheat bread†	Thin slice toast
Butter†	"Fresh" butter†	Butter†	Butter†	Butter†	Butter	Butter†	
Milk	Milk limited	Milk	Milk	Milk	Milk as indicated	Milk	Skim milk
Tea†	Tea†	Tea†	Tea†	Tea†	Tea†	Tea†	Tea†
Dessert	Dessert	Dessert	"Smooth" dessert	Dessert with fruit	Fruit without sugar	Dessert	Fruit or fruit whip

Dinner Meat or fish	Meat or fish *neither salted nor smoked*	Eggs or cheese	Tender meat or fish	Meat or fish	Meat, egg, fish, or cheese	Meat or fish, especially **liver, kidney, or oysters**	Tender meat, light colored fish, or poultry
Potato	Potato	Potato	Potato (except fried)	Potato with skin	1 small potato or bread	Potato	
Vegetable (cooked)	Vegetable (cooked)	Vegetable (cooked)	"Smooth" **vegetable**	Vegetable (cooked)	Vegetable (cooked)	Green vegetable (cooked)	Green vegetable (cooked)
Vegetable (raw)	Vegetable (raw)	Vegetable (raw)	Tender lettuce or cabbage shredded, or gelatin salad	Vegetable (raw)	Vegetable (raw)	Green vegetable (raw)	Green vegetable (raw)
Bread†	Bread†	Bread†	Bread†	Bread†		Whole wheat bread†	Thin slice toast
Butter†	"Fresh" butter†	Butter†	Butter†	Butter†	Butter	Butter†	
Dessert	Dessert	Dessert	"Smooth" dessert	Cereal pudding or dessert with fruit	Fruit without sugar	Fruit dessert, especially prunes, apricots, peaches or strawberries	Gelatin dessert
Coffee† with milk or cream and sugar	Coffee† with milk or cream and sugar	Coffee† with milk or cream and sugar	Coffee† with milk or cream and sugar	Coffee† with milk or cream and sugar	Coffee† (with milk or cream)	Coffee† with milk or cream and sugar	Clear coffee†
Milk	Milk	Milk	Milk	Milk	Milk as indicated		Skim milk
Use of Diet	Renal insufficiency, edema	Gout or some types of arthritis	Ulcers, spastic colon, colitis	Atonic constipation	Diabetes	Anemia	Celiac disease, steatorrhea

*Salt content of diet may be further reduced by the omission of all added salt in preparation of foods.

†If desired.

**Meat grinder and strainer essential in reducing undigestible residue. "Smooth" diet may be made bland by limitation of seasoning and highly flavored foods. The reader is referred to specific chapter for underlying principles involved in diet adjustments.

TABLE 101 B

SUMMARY OF ADJUSTMENTS OF THE NORMAL DIET TO MEET THERAPEUTIC NEEDS

1	2	3	4	5	6	7	8
NORMAL DIET	LOW CALORIES	HIGH CALORIES	HIGH PROTEIN	LOW PROTEIN	HIGH CALCIUM, HIGH VITAMIN	HIGH FAT, LOW WATER, LOW CARBOHYDRATE	LOW FAT, HIGH CARBOHYDRATE AND PROTEIN
BREAKFAST Fruit	Fresh fruit	Sweet fruit	Fruit	Fruit	Fruit	Fruit without sugar	Fruit
Whole grain cereal with sugar and cream or milk		Cereal with sugar and cream	Cereal with sugar and milk	Cereal with sugar and cream	Cereal with sugar and milk or cream		Cereal with sugar and skim milk
Egg and/or bacon†	Egg	Egg and/or bacon	2 eggs		Egg	2 eggs with butter	
Toast or muffins	1 slice toast	2 thin slices toast	1 slice toast or muffin	Toast		Gluten or soybean toast	Toast or muffin
Butter	1 pat butter	2 pats butter	Butter	Butter	Butter	Butter	
Marmalade or jam		Marmalade or jam	Marmalade or jam	Marmalade or jam	Marmalade or jam		Marmalade or jam
Coffee† with milk or cream and sugar	Coffee† without cream or sugar	Coffee† with cream and sugar	Coffee† with milk and sugar	Coffee† with cream and sugar	Coffee† with milk and sugar		Coffee† with skim milk and sugar
LUNCHEON Soup	Clear soup	Cream soup	Cream soup	Clear soup	Cream soup		Clear soup with crackers
Entree and/or salad Salad dressing	Meat or fish entree and/or salad with little or no dressing	Entree and salad Salad dressing	Meat or fish entree or salad Salad dressing	Entree and/or salad **without** meat, fish, **eggs**, or cheese Salad dressing	Entree and salad Salad dressing	Meat or fish entree and/or salad with much salad dressing	Starchy or protein entree
Bread or rolls† (whole grain or enriched)	1 slice bread or 1 roll†	Bread or rolls	Bread or rolls†	Bread or rolls†	Bread or rolls†	Gluten or soybean bread†	Bread or rolls
Butter†	1 pat butter	Butter	Butter†	Butter†	Butter	Butter or peanut butter†	Jam
Milk	Skim milk	Milk	Milk		Milk		Skim milk
Tea†	Tea†	Tea†	Tea†	Tea†	Tea†		Tea†
Dessert	Fruit	Dessert	Egg or milk dessert	Fruit	Fruit or milk dessert	Diabetic gelatin made with cream	Fruit or cereal dessert without cream

DINNER Meat or fish	Meat or fish	Meat or fish	Meat or fish	Meat or fish—small serving	Meat or fish	Meat	Lean meat or fish
Potato	1 very small potato†	Potato	Potato	Potato	Potato		Potato
Vegetable (cooked)	Vegetable (cooked)	Vegetable (cooked)	Vegetables (cooked and/or raw)	Vegetable (cooked)	Vegetable (cooked)	Vegetable (cooked)	Vegetable (cooked)
Vegetable (raw)	Vegetable (raw)	Vegetable (raw)	Cheese salad	Vegetable (raw)	Vegetable (raw)	Vegetable (raw) with oil dressing	Vegetable (raw)
Bread†		Bread	Bread†	Bread†	Bread†	Gluten or soybean bread†	Bread
Butter†		Butter	Butter†	Butter†	Butter†	Butter	1 pat butter
Dessert	Fruit or gelatin	Milk, egg or cereal dessert	Milk, egg or gelatin dessert	Fruit dessert	Fruit dessert	Custard made with egg yolk and cream	Cereal or fruit dessert
Coffee† with cream or milk and sugar	Clear coffee†	Milk‡	Milk with all meals	Coffee† with cream and sugar	Milk with all meals		Coffee† with milk and sugar
USE OF DIET	Reduction, hypertension, hypothyroidism	Any undernourished state Hyperthyroidism	Albuminuria, recovery from a wasting disease Toxemias of pregnancy	Uremia, acute nephritis	Lead fixation, rheumatic fever, pregnancy and lactation, fractures, tuberculosis	Epilepsy, urinary infections, sedation	Liver and gall bladder diseases

This table is reproduced from Hawley-Maurer-Mast: The Fundamentals of Nutrition, Charles C Thomas Co.

†If desired.

‡Extra nourishment, as milk, chocolate, malted or fruit drinks, midmorning, midafternoon, and at bedtime.

PART IV

THE CHOICE, PREPARATION, AND SERVING OF FOODS

FOREWORD TO PART IV

The plan of teaching in the following pages conforms to the outlines formulated jointly by the National League of Nursing Education and the American Dietetic Association. These are published by the League in *"A Curriculum Guide for Schools of Nursing"* and by the Dietetic Association as a book, *A Manual for Teaching Dietetics to Student Nurses.* They may be equally well adapted for use in teaching short courses in nutrition to students of senior high school age, or older groups.

The teaching of foods and cookery necessitates a laboratory course to parallel the theory of nutrition given as a lecture course, and such a course is presented here in detail. The lessons are intended to illustrate the principles of simple cookery and to demonstrate the preparation of nutritionally well-balanced meals. It is not the purpose to include a wide variety of recipes. For these the student is referred to the many excellent books now available. This plan may also be followed in the courses in "Special Conditions" and in "Diet Therapy," but since obviously many of the processes would be repetitive of those used in "Foods and Cookery," demonstration trays introduced in the lecture period may serve to illustrate the necessary modification of diet in the condition discussed. A course illustrative of this method, given at the Strong Memorial Hospital is presented. This plan of teaching diet therapy keeps adequate nutrition and the normal diet constantly in the student's mind and stresses that therapeutic diets are not "special" diets but simply the normal diet adjusted in one particular or another to the therapeutic need.

In the first hour of the course the students examine the current menu of the patients' house diet in the light of normal nutrition,

and review with the instructor the fundamentals of nutrition as a basis for adjustment to abnormal conditions. In the second hour they decide upon the size of portions and the protein, fat, and carbohydrate values of those portions.

As the course proceeds they themselves are assigned to make the adjustments for the diseases under discussion. The demonstration tray helps to fix in the mind these adjustments and the appearance of the food suggests the probable psychological effect upon the patient and the part the nurse can play in encouraging him to follow the diet.

A. AN OUTLINE OF TWENTY LABORATORY LESSONS

Unit I. Introduction.

Lesson 1. General instructions, measurements, beverages.
Lesson 2. Tray service.

Unit II. Foods High in Energy Value.

Lesson 3. Foods rich in carbohydrates.
Cereals; cereal and cornstarch puddings.
Lesson 4. Foods rich in carbohydrates, continued.
Batters and doughs.
Lesson 5. Food rich in carbohydrates and fat.
Cream sauces, salad dressings.

Unit III. Foods High in Protein.

Lesson 6. Milk and eggs.
Lesson 7. Meat and fish broths; cheese dishes.
Lesson 8. Fish, meats, and poultry.

Unit IV. Foods High in Minerals and Vitamins.

Lesson 9. Creamed and scalloped dishes.
Lesson 10. Vegetables.
Lesson 11. Fruits.

Unit V. Foods High in Minerals and Vitamins, continued.

Lesson 12. Combination of fruits with other foods.
Lesson 13. Salads.
Lesson 14. Salads, continued.

Unit VI. Water and Cellulose.

Lesson 15. Liquid nourishments; desserts of high cellulose content.

Unit VII. Meal Planning and Preparation.

Lesson 16. An adequate diet at medium or low cost. Table service.
Lesson 17. An adequate diet at medium or low cost. Table manners.
Lesson 18. Adaptation of the family menu to children at low cost.
Lesson 19. An adequate diet at high cost.
Review of table or tray service.

Unit VIII. Examination.

Lesson 20. Dinner menu.

A SUGGESTED CORRELATION OF LECTURES AND LABORATORY LESSONS FOR A SIXTY-HOUR COURSE IN NUTRITION AND COOKERY

Lectures—Twenty 1-hour periods.
Laboratory—Twenty 2-hour periods.

Unit I. Introduction (2 hours)
- A. Nutrition and its place in everyday life.
- B. Historical development of nutrition.
- C. Processes by which the body uses food.
- D. The endocrines.

Unit II. Energy Metabolism (3 hours)
- A. Definition.
- B. Basal metabolism.
- C. Energy requirement.
- D. Standards.
- E. Food constituents as sources of energy.
- F. Optimum, excessive, inadequate, intake.
- G. Foods high in energy value.
- H. Methods of computing caloric values.

Unit III. Protein Metabolism (3 hours)
- A. Function as tissue builder.
- B. Chemical composition.
- C. Sources.
- D. Requirement.
- E. Standards.
- F. Effects of low and high intake.

I. Introduction (4 hours)

Lesson 1.
- a. General instructions.
- b. Measurements.
- c. Beverages.

Lesson 2.
- a. Tray service
- b. Three meals of an adequate normal diet demonstrated.

II. Foods High in Energy Value (6 hours)

Lesson 3. Foods rich in carbohydrate.
- a. Cereals and cereal products.
- b. Cereal and cornstarch puddings.

Lesson 4. Foods rich in carbohydrate, continued.
- a. Batters and doughs.

Lesson 5. Foods rich in carbohydrate and fat.
- a. Cream sauces.
- b. Salad dressings.

III. Foods High in Protein (6 hours)

Lesson 6. Milk and eggs.
- a. Eggs.
- b. Custards.
- c. Cooked salad dressings.
- d. Junket.

Lesson 7. Broths and cheese dishes.

Lesson 8. Fish, meats, and poultry.
- a. Classification, selection, cuts, care, cleaning.
- b. Oven and pot roasts, fricassees.
- c. Broiling and pan broiling.

Unit IV. Mineral Metabolism (3 hours)

A. General functions.
B. The more important minerals.
C. Standards.
D. Results of deficiencies.
E. Acid-base balance.
F. Sources.
G. Vegetables as one source.
H. Classification of vegetables according to carbohydrate content.

IV. Foods High in Minerals and Vitamins (6 hours)

Lesson 9. Cream soups and creamed and scalloped dishes. Review croutons and Melba toast.

Lesson 10. Vegetables.
a. Selection, care, preparation, and preservation.
b. Canapés, cocktails, and sandwiches.

Lesson 11. Fruits.
a. Preparation of fresh fruits.
b. Cooking of dried and stewed fruits.
c. Weighing of foods in 100 calorie portions.

Unit V. Vitamins (3 hours)

A. Historical review.
B. Functions.
C. Requirement.
D. Stability.
E. Sources.
F. Fruits as one source.
G. Classification of fruits according to carbohydrate content.

V. Foods High in Minerals and Vitamins (6 hours)

Lesson 12. Combinations of fruits with other foods.
a. Gelatins.
b. Custards.

Lesson 13. Salads.

Lesson 14. Salads (continued).

Unit VI. Water and Cellulose (1 hour)

A. Water metabolism.
1. Functions.
2. Requirement.
3. Sources.
4. Water balance.
5. Foods with high water content.

B. Cellulose.
1. Function.
2. Factors which affect requirement.
3. Foods with high cellulose content.

VI. Water and Cellulose (2 hours)

Lesson 15. Foods with high water and cellulose content.
a. Fruit and milk drinks.
b. Sherbets.
c. Desserts of high cellulose content.

Unit VII. Food Selection and Meal Planning for Individuals and Groups (4 hours)

A. Review and summary of the essentials of an adequate diet.

B. Food for the family.
1. Factors which affect selection.
2. Factors to consider in menu planning.
3. Table service.
4. Suitable menus for breakfast, luncheon, and dinner.
5. Planning of menus for a family.

Unit VIII. Examination in Nutrition (1 hour)

VII. Meal Planning and Preparation (8 hours)

Lesson 16. An adequate diet at medium or low cost. Table service.

Lesson 17. An adequate diet at medium or low cost. Table manners.

Lesson 18. Adaptation of the family menu to children at low cost.

Lesson 19. An adequate diet at high cost. May be adapted to private patient tray service.

VIII. Examination in Cookery (2 hours)

Lesson 20. Preparation of a dinner menu in groups of two.

B. AN OUTLINE OF FIFTEEN LABORATORY LESSONS

Unit I. Introduction

Lesson 1. General instructions, beverages, tray service. (Lessons 1 and 2 of 40 hr. course.)*

Unit II. Foods high in energy value

Lesson 2. Foods rich in carbohydrates. Cereals and cereal products. Batters and doughs. (Lessons 3 and 4 of 40 hr. course.)

Lesson 3. Foods rich in carbohydrate and fat. Cream sauces, salad dressings. (Lesson 5 of 40 hr. course.)

Unit III. Foods high in protein

Lesson 4. Milk and eggs. (Lesson 6 of 40 hr. course.)

Lesson 5. Cheese, fish, meats, and poultry. (Lesson 7 of 40 hr. course.)

Lesson 6. Fish, meats, and poultry, continued. (Lesson 8 of 40 hr. course.)

Unit IV. Foods high in minerals and vitamins

Lesson 7. Creamed and scalloped dishes. (Lesson 9 of 40 hr. course.)

Lesson 8. Vegetables. (Lesson 10 of 40 hr. course.)

Unit V. Foods high in minerals and vitamins, continued

Lesson 9. Fruits. (Lesson 11 of 40 hr. course.)

Lesson 10. Combination of fruits with other foods. (Lesson 12 of 40 hr. course.)

Unit VI. Water and cellulose

Lesson 11. Liquid nourishments. Desserts and salads of high cellulose content. (Lesson 15 of 40 hr. course.)

Unit VII. Complete day's dietaries

Lesson 12. An adequate diet at medium cost for the normal adult. (Lesson 16 of 40 hr. course.)

Lesson 13. An adequate medium cost diet for the normal adult. (Lesson 17 of 40 hr. course.)

Lesson 14. An adequate low cost diet adapted to children. (Lesson 18 of 40 hr. course.)

Unit VIII. Examination

Lesson 15. Preparation of a dinner.

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*The parentheses are added to show how the 40 hr. course may be shortened to a 30 hr. course.

A SUGGESTED CORRELATION OF LECTURES AND LABORATORY LESSONS FOR A FORTY-FIVE-HOUR COURSE IN NUTRITION AND COOKERY

Lectures—Fifteen 1-hour periods
Laboratory—Fifteen 2-hour periods

Unit I. Introduction (1 hour)
- A. Nutrition and its place in everyday life.
- B. Historical development of the science of nutrition.

Unit II. Energy Metabolism (2 hours)
- A. Definition.
- B. Basal metabolism.
- C. Energy requirement.
- D. Standards.
- E. Food constituents as sources of energy.
- F. Optimum, excessive, inadequate intake.
- G. Foods high in energy value.
- H. Methods of computing calorie values.

Unit III. Protein Metabolism (3 hours)
- A. Function as tissue builder.
- B. Chemical composition.
- C. Sources.
- D. Requirements.
- E. Standards.
- F. Effects of low and high intake.

I. Introduction (2 hours)

Lesson 1.
- a. General instructions.
- b. Beverages.
- c. Tray service.
- d. Three meals of an adequate normal diet demonstrated.

II. Foods High in Energy Value (4 hours)

Lesson 2. Foods rich in carbohydrates.
- a. Cereals and cereal products.
- b. Cereal and cornstarch puddings.
- c. Batters and doughs.

Lesson 3. Foods rich in fat and carbohydrate.
- a. Cream sauces.
- b. Salad dressings.

III. Foods High in Protein (6 hours)

Lesson 4. Milk and eggs.
- a. Eggs.
- b. Custards.
- c. Cooked salad dressing.
- d. Junket.

Lesson 5. Cheese, fish, meat, and poultry.
- a. Cheese dishes.
- b. Classification, selection, cuts, care, and cleaning of fish, meats, and poultry.
- c. Beef juice, beef tea, broths, and meat soups.

Lesson 6. Fish, meats, and poultry, continued.
- a. Oven and pot roasts, fricassees.
- b. Steaks, chops, chicken.

Unit IV. Mineral Metabolism (2 hours)

A. General functions.
B. The more important minerals.
C. Standards.
D. Results of deficiencies.
E. Foods rich in minerals.
F. Classification of vegetables according to carbohydrate content.
G. Care and cooking of vegetables.

IV. Minerals (4 hours)

Lesson 7. Cream soups and creamed and scalloped dishes.

Lesson 8. Vegetables as *one* source.

a. Preparation and cooking of green and root vegetables.
b. Canapés, cocktails, and sandwiches.

Unit V. Vitamins (2 hours)

A. Historical review.
B. Functions.
C. Sources.
D. Stability.
E. Requirement.
F. Foods rich in vitamins.
G. Classification of fruits according to carbohydrate content.
H. Care and cookery of fruits.

V. Vitamins (4 hours)

Lesson 9. Fruits as *one* source.

a. Raw, canned, dried, and frozen fruits.
b. Cooking of dried and stewed fruits.
c. Preparation of fresh fruits.

Lesson 10. Combination of fruits with other foods.

a. Gelatins.
b. Custards.
c. Salads.

Unit VI. Water and Cellulose (1 hour)

A. Water metabolism.
  1. Functions.
  2. Sources.
  3. Requirement.
  4. Water balance.
  5. Foods with a high water content.
B. Cellulose.
  1. Composition and digestibility.
  2. Function.
  3. Foods with high cellulose content.
  4. Factors which affect requirement.

VI. Water and Cellulose (2 hours)

Lesson 11. Foods with high water and cellulose content.

a. Fruit and milk drinks.
b. Sherbets.
c. Desserts and salads of high cellulose content.

Unit VII. Complete Day's Dietaries (3 hours)

A. Review and summary of the essentials of an adequate diet.

B. Food for the family.

1. Factors which affect selection.
2. Factors to consider in menu planning.
3. Table service.
4. Suitable menus for breakfast, luncheon, and dinner.
5. Planning of menus for the day and week for a family with children of different ages.

Unit VIII. Examination (1 hour)

VII. Complete Day's Dietaries (6 hours)

Lesson 12. An adequate diet for the normal adult at medium cost.

Lesson 13. An adequate diet for the normal adult at medium cost.

Lesson 14. Adaptation of the family menu to children at low cost.

Unit VIII. Examination (2 hours)

Lesson 15. Preparation of a dinner menu.

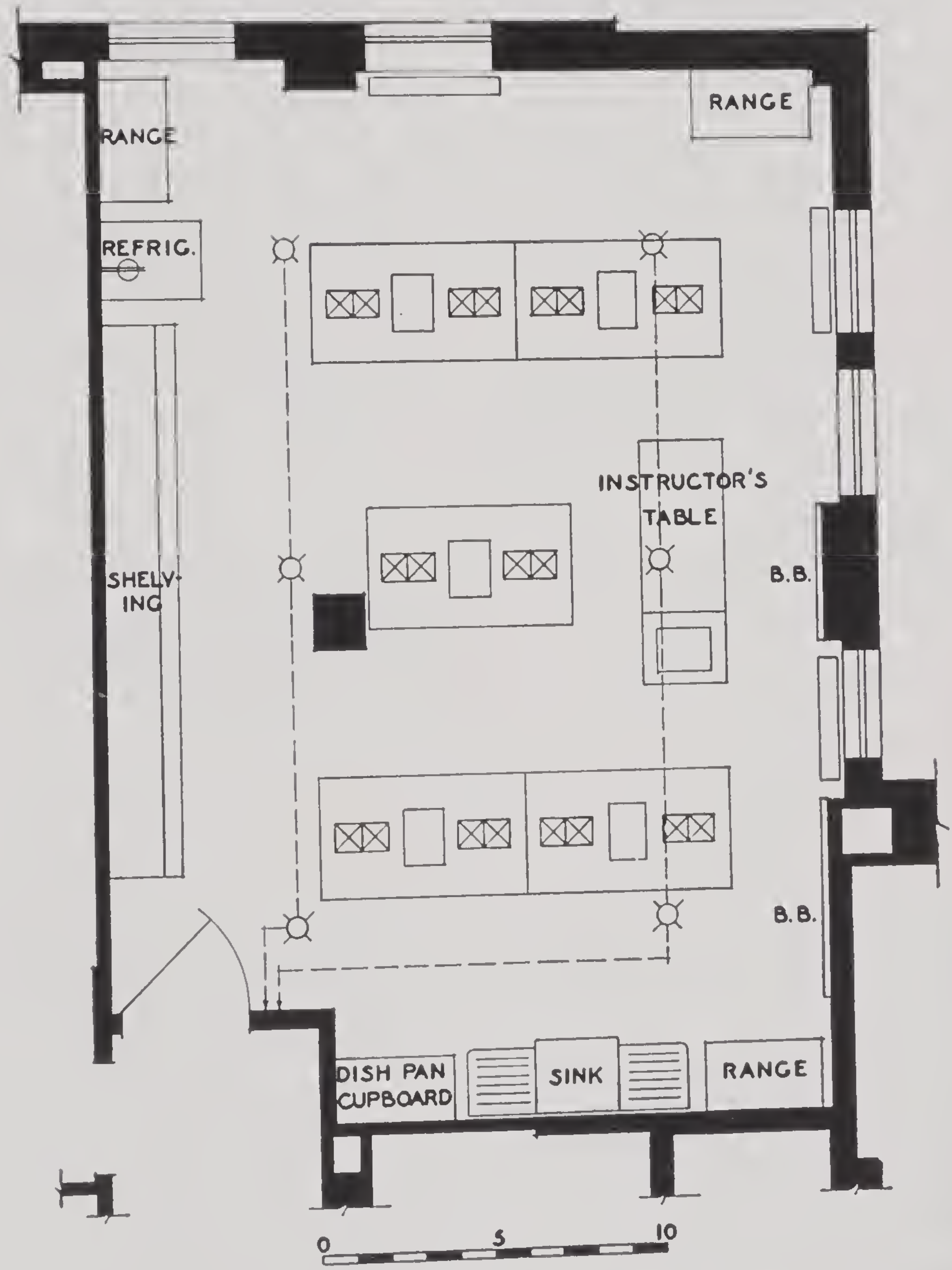


Fig. 86.—Floor plan of a diet laboratory. (Courtesy of Kaelber and Wassdorp, Architects, Rochester, N. Y.)

Nutrition Laboratory Equipment for a Class of Twenty

Dish Cabinet

24 Tumblers
24 Iced tea glasses
24 Orange juice glasses
24 Glass sherbets
24 Salt shakers
24 Pepper shakers
24 Tea cups
24 Saucers
24 Pitchers—1 oz.
24 Pitchers—2½ oz.
24 Sugar bowls
24 Egg cups
24 Dinner plates
24 Salad plates
24 Bread and butter plates
24 Cereal dishes
24 Sauce dishes

Silver Drawers

24 Silver knives
24 Bread and butter knives
24 Silver forks
24 Bouillon spoons
24 Iced tea spoons
48 Teaspoons

Cabinet Drawers

1 Bread knife
1 Carving knife and fork
4 Nickel teaspoons
4 Nickel tablespoons
1 Pair scissors
1 Ice pick
1 Can opener
1 Bottle brush
4 Case forks
4 Case knives
4 Grapefruit knives
1 Lemon and cheese grater
Corks, soap, matches
2 Sets measuring spoons
1 Potato ricer
1 Ice mallet
6 Skimmers
6 Large egg beaters

Linen

42 Aprons
42 Dish cloths
42 Sink cloths
42 Holders
6 Food cloths
6 Lettuce bags
1 Canvas ice bag
42 Glass towels
42 Dish towels

Supply Shelves

2 Large canisters
12 Small canisters
12 Spice bottles
3 Flavoring bottles

Supply Table Cabinets

2 Small double boilers, complete
12 Sets gem pans (6 gems each)
6 Biscuit pans
2 Tin utility plates
2 Large covers (tin)
2 Small covers (tin)
4 Crockery bowls
2 Glass casseroles
1 Nest glass bowls
6 Crockery platters
6 White plates
6 White fruit saucers
2 Large sauce pans
2 Small sauce pans
6 Aluminum sauté pans
1 Flour sifter
3 Aluminum trays
1 Small round tray
1 Small oval tray
3 Aluminum or silver plate covers

Equipment Cabinet

4 China tea pots
1 Individual tea pot
1 Individual hot water pitcher
6 Lemon juicers
6 Orange juicers
24 Cocotte dishes
6 Custard cups
2 Salt shakers
2 Pepper shakers
1 Sugar shaker
Tooth picks and labels
2 Pint measuring cups
1 Enamel funnel
3 Enamel pitchers
6 Coffee pots
1 Coffee percolator
1 Drip coffee maker
1 Vacuum drip coffee maker

Sink Cabinet

2 Large agate dish pans
10 Small agate dish pans
1 Wire dish drainer
1 Enamel basin
1 Garbage strainer
1 Sink brush
1 Sink shovel
1 Soap shaker
1 White saucer (soap)
1 Paper towel holder

Stoves and Sinks

12 White saucers } for soap and matches
6 Cups }
6 Garbage strainers
6 Sink brushes
6 Sink shovels

Miscellaneous

2 Towel racks
1 Garbage pail
1 Rubbish basket
1 Blackboard eraser
Charts
Illustrative material

Individual Desk Equipment

I. Large drawer
1 Tin utility plate
2 Measuring cups
2 Muffin cups
1 Muffin ring
1 Salt dredger
1 Pepper dredger

II. Small drawer
1 Case fork
1 Case knife
1 Spatula
1 Vegetable knife
1 Wooden spoon
2 Tablespoons
2 Teaspoons
1 Set measuring spoons
1 Vegetable brush
1 Cup strainer
1 Egg beater

III. Cabinet
2 Double boilers
2 Large saucepans
2 Small saucepans
4 Covers
2 Large bowls
2 Small bowls
2 Small frying pans
2 Bowl strainers

Staple Supplies

1. Spices and condiments:
   Salt
   Pepper
   Nutmeg
   Cinnamon
   Ginger
   Mustard
   Paprika
   Cayenne pepper
   Allspice
   Mace
   Cloves
2. Baking powder
3. Soda bicarbonate
4. Flavoring extracts:
   Vanilla
   Orange
   Lemon
5. Sugar:
   Granulated
   Brown
   Confectioners'
6. Cornstarch
7. Granulated gelatin
8. Rice
9. Tapioca
10. Cream of tartar
11. Tea
12. Coffee
13. Cocoa
14. Chocolate
15. Malted milk
16. Flour
17. Soap
18. Paper towels
19. Paper napkins and place covers
20. Waxed paper

Student Housekeeper's Duties

I. Report to instructor on arrival at Laboratory.
II. Unlock all drawers and cabinets.
III. Distribute clean aprons, towels, and holders when necessary.
IV. Check food on supply table and in icebox.
V. Arrange food on supply table.
  A. Protect supply table with molding boards.
  B. Pour milk and cream into pitchers and label.
  C. Remove all supplies from paper and place on platters, plates, or in bowls.
  D. Keep supply table neat throughout the lesson.
VI. Have responsibility of ovens during the lesson.
VII. Take charge of any special work assigned by instructor.
VIII. Wash dishes at main sink.
IX. At close of lesson:
  A. Take care of supplies as instructed.
  B. Leave stoves, icebox, supply table, sink, drainboards, and towel racks in order.
  C. Lock windows, drawers, and cabinets, and return key to instructor.

NOTE: The author has found that this plan has worked well in a class of twenty with two students appointed as housekeepers for each lesson. Each instructor will wish to work out her own plan according to the facilities available.

Rules for Working

1. Wash hands with soap and water. Have fingernails clean. Wash the hands again whenever necessary. Use hand towels only for hands; dish towels only for dishes.
2. Hair should be neatly combed and a hair net should be worn.
3. Jewelry should not be worn in the laboratory.
4. Assemble all necessary *utensils* and *materials* before beginning work.
5. Use utility plate to carry materials from supply table to desk, from desk to ovens, and for soiled utensils at the desk.
6. *Save work by saving dishes;* measure dry materials first, then liquids, then fats, and you will need to use only one cup.
7. Cover all containers on supply table as soon as you have measured what you need.
8. *Clear as you work;* put dishes to soak as soon as they are emptied.
9. Never taste from mixing spoon. Use clean teaspoon.
10. *Think out a plan of work;* then work quickly, quietly, and carefully.

Washing Dishes

1. Scrape or rinse all waste food from dishes. Wipe greasy pans with soft paper.
2. Sort dishes according to size and kind.

3. Use plenty of very hot soapy water.
4. Rinse with clear hot water.
5. Wipe with clean, dry towels—glass towels for glass, crash towels for other dishes.
6. Wash glass first, then silver, then china, and lastly cooking utensils.
7. To scour:
    a. Tin or enamel ware—use Bon Ami.
    b. Agate ware—use ground pumice or commercial powders, such as Sunbrite, Dutch Cleanser, or Bon Ami.
    c. Steel utensils—as agate ware. A wet cork dipped into the powder is useful for these.

Care of Sink

1. Clear sink of all waste matter.
2. Wash every part with hot soapy water. Scour if necessary. Flush with hot water.
3. When much greasy water has been poured down the sink pipe, a solution of caustic soda or lye should be used, since grease is liable to collect and clog the pipes and drain.
4. Carefully wipe all wood, stone, or metal work above and around sink.
5. Leave no wet cloths about.

Care of Tables and Boards

1. Remove all crumbs and wash thoroughly with a wet cloth.
2. Wet bristles of brush, dip into scouring powder, and scrub with grain of wood.
3. Rinse off suds.
4. Rinse cloth, wring as dry as possible, and wipe boards and table.
5. Ammonia water or chlorinated soda used after washing will remove grease spots and keep wood sweet.

Care of the Refrigerator

1. Warm foods or foods of strong flavor should not be placed in the refrigerator.
2. Keep foods of a kind together. Place liquids where they may easily be seen.
3. Keep milk and butter covered.
4. Never wrap ice in paper or blanket. Ice must melt in order to keep refrigerator cold. For care of electric and gas refrigerators follow manufacturer's directions.
5. Keep refrigerator doors closed and work quickly when putting in or removing food.
6. Examine refrigerator daily that no food may be left to spoil and cause bad odors.

To clean:

a. Remove all food; take out shelves and ice racks.
b. Scrub shelves and racks with scrubbing brush and hot soapy water. Scald and place in sun or air to dry.
c. Scrub walls and floor of refrigerator in the same manner.
d. Leave refrigerator open until it is thoroughly dry. Replace racks, ice, shelves, and food, wiping all food dishes on the outside.
e. Close doors and wipe exterior with a damp cloth.

Purposes, Methods, and Principles of Cookery

I. Definition:

Cookery is the science and art of preparing food for the human body by application of heat.

II. Purposes:

A. To kill bacteria.

B. To make food easier to digest.

C. To improve appearance and flavor.

III. Methods:

A. *Boiling*—cooking in boiling water, 212° F. at sea level. Water simmers at 180° to 210° F.

B. *Steaming*—subjecting to steam with or without pressure.

C. *Stewing*—cooking in a small amount of water for a long time at simmering temperature.

D. *Broiling*—cooking over or in front of a clear fire, turning frequently. *Pan-broiling*—cooking in a hissing hot frying pan, turning often as in broiling.

E. *Roasting*—cooking before a clear fire on a spit. Meats cooked in a range oven, though really baked, are said to be roasted.

F. *Baking*—cooking in a range oven.

G. *Frying*—cooking by means of immersion in deep fat raised to a temperature of 350° to 400° F.

H. *Sautéing*—frying in a small quantity of fat in frying pan or griddle. The food is cooked on one side, then turned and cooked on the other. Food so cooked is much more difficult to digest than when fried in deep fat, due to the fat absorbed by the food.

I. *Braising*—stewing and baking (meat).

J. *Fricasseeing*—a combination of sautéing with stewing or steaming.

IV. Principles:

a. *Protein* foods are toughened by high temperature. It is best, therefore, to use a temperature of 350° F. or less for baking, or 180° to 210° F. for cooking in water.

b. *Starchy* foods (carbohydrates) are usually cooked with moist heat at a temperature of 212° F. in order to swell and burst the starch grains and change the starch to a colloidal form. The time depends upon the food and its condition.

c. *Fats* of low melting points like butter decompose readily and should be cooked at low temperature. Fats of higher melting points are less readily decomposed and may be subjected to higher temperatures.

d. *Minerals and vitamins* are best conserved by avoiding the soaking of foods, and by steaming, baking, or boiling in a small quantity of water, only until tender.

Measurements

A speck is the amount which will rest on the tip of a vegetable knife.

A spoonful is a spoon level full. Use a straight edge, like the back of a case knife, to obtain a level surface.

Half a spoonful is a spoonful divided lengthwise.

One-fourth a spoonful is a half spoonful divided crosswise.

A cupful is a cup level full.

To measure a cupful of flour, sugar, etc., fill the cup with a spoon or a scoop, and level the top with the back of a case knife. Never shake or press down flour or sugar, and do not scoop it up with a cup. Measure flour after sifting once.

Abbreviations

c.—cupful
tbs.—tablespoonful
tsp.—teaspoonful
spk.—speck
qt.—quart
pt.—pint
lb.—pound
oz.—ounce
hr.—hour
m.—minute

Equivalents

3 tsp.=1 tbs.
8 tbs.=½ c. or 1 gill
2 gills=1 c.
2 c.=1 pt.
4 c. or 2 pt.=1 qt.
4 qt.=1 gallon
8 qt.=1 peck
4 pk.=1 bu.

Lesson 1. Demonstration. Measurements and Beverages

Supplies

Tea leaves
Coffee, regular grind
Coffee, drip grind
1 Egg
1 Lemon
Powdered sugar
Loaf sugar
Coffee cream
Cracked ice
Coffee substitutes
  a. Kaffee Hag
  b. Postum
  c. Sanka
1 Cup flour

Equipment

1 Individual tea pot
1 Individual hot water pitcher
2 Enamel coffee pots
1 Coffee percolator
1 Coffee dripolator
1 Vacuum drip coffee maker
6 Tea cups and saucers
6 Silver teaspoons
2 Iced tea spoons
2 Iced tea glasses
2 Salad plates
2 Paper doilies
8 Paper napkins
1 Small oval tray
1 Small round tray
1 Sugar bowl
1 Small creamer
1 Bread and butter plate
1 Tea kettle
1 Measuring cup
1 Set measuring spoons
1 Case knife
1 Tablespoon
1 Bowl
1 Flour sieve

Unit I. Introduction

Lesson 1. General Instructions, Measurements, Beverages

I. General instructions for laboratory work
   A. Seating assignments
   B. Individual desk equipment
   C. General equipment
   D. Supply table
   E. Techniques

II. Demonstration
   A. Measurements
   B. Beverages
      1. Tea
         1 tsp. or 1 individual bag of tea leaves
         1 c. freshly boiling water
         a. Hot
            Scald an earthen or enamel ware pot. Empty and put in tea leaves. Add freshly boiling water. Steep for 2 to 3 minutes. Strain into hot cups and serve clear or with sugar, cream, or lemon.
         b. Iced
            Make as for hot tea. Strain into glasses filled with cracked ice.
      2. Cocoa (1 serving)

2 tsp cocoa	¼ c. cold water
2 tsp. sugar	¾ c. milk
speck of salt	3 drops vanilla

Mix cocoa, sugar, salt, and water. Boil for 2 minutes. Add to the milk which has been heated in the double boiler. Add vanilla and beat with egg beater till frothy to prevent formation of scum. Serve plain, with whipped cream or with a marshmallow.

      3. Coffee
         1 rounded tbs. coffee grounds for each cup to be served, plus one for the pot.
         1 c. water. (Always allow for one extra cup.)
         a. Boiled
            (1) Scald pot. Empty. Add freshly boiling water to grounds and bring back to a boil. Remove from heat and set aside to steep for 2 or 3 minutes. Add 1 tbs. of cold water to perfect clearing. Strain and serve at once in hot cups, clear or with sugar and cream.
            (2) With egg white. Mix grounds with slightly beaten egg white (1 tbs. for each tbs. grounds) and proceed as above. Freshly opened egg shells, if washed before cracking, may also be used for clearing.
         b. Percolated (requires finer grind)
            Scald percolator. Empty. Put either hot or cold water in bottom and grounds in the strainer. Set over fire and allow to percolate slowly for 6 to 8 minutes, or until of desired strength.

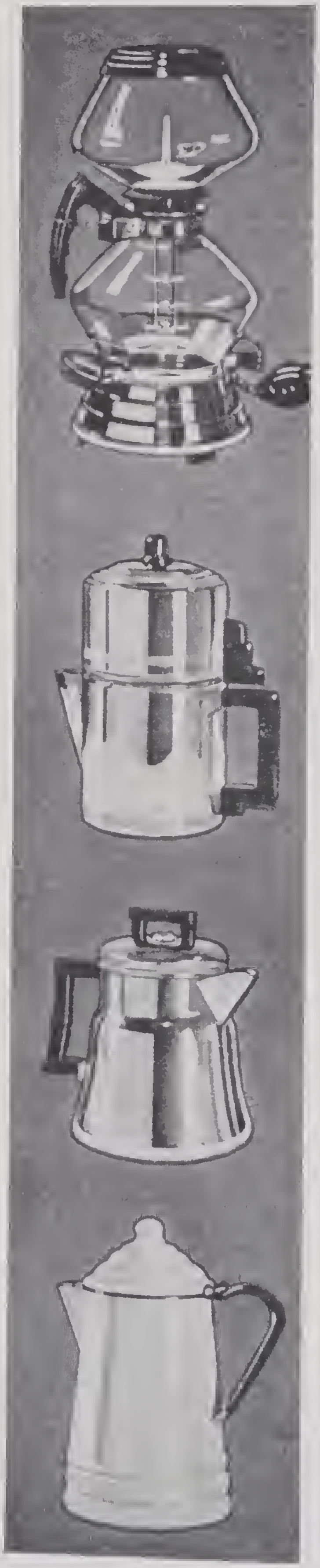


Fig. 87.—Various types of coffee makers.

c. Filtered or drip (requires drip grind)

Scald pot. Empty. Put grounds in strainer compartment. Pour on freshly boiling water and allow to stand in warm place, closely covered until filtered. Serve at once.

d. Vacuum drip (requires drip grind)

Place either hot or cold water in decanter, arrange filter in upper funnel and fit into decanter. Put coffee grounds in the upper part and cover. Place over heat. When water boils the pressure formed causes the water to rise into the funnel. Reduce the heat. The vacuum formed in the decanter siphons the coffee down in a few seconds. Remove funnel and serve immediately.

e. Demitasse

For after-dinner coffee, use twice the amount of coffee or half the amount of water given above, and prepare by the method desired, preferably filtered.

f. Iced

Make as for hot coffee. Strain into glasses filled with cracked ice.

4. Coffee substitutes, discussion of making, use, and comparative costs

III. Sampling of coffee and comparison of results from the various methods used

A. Good coffee

1. Clear and sparkling in color
2. Tantalizing in aroma
3. Full and smooth in flavor

B. Poor coffee

1. Cloudy in color
2. Heavy with sediment
3. Flavor obscured by bitterness

IV. Discussion

A. Table manners (see page 535)

May be discussed at this lesson, at the discretion of the instructor, in order that they may be emphasized throughout the classes.

Review Questions

In cookery procedures, what are some of the principles of good organization?

Define cookery.

State the purposes of cooking food.

State the difference between boiling and simmering.

Why are accurate and level measurements essential in cookery?

Why is *freshly* boiling water used in making tea and coffee?

Unit I. Introduction, Cont'd

Lesson 2. Tray Service

I. Discussion

A. Importance of attractive tray

1. The meals are the events of the day.
2. A sick person is an abnormal person and may be acutely sensitive to any carelessness.

B. Requirements

1. The linen, silver, glassware, china, and food must be absolutely clean.
2. The tray must be sufficiently large not to appear crowded.
3. The arrangement of the obligatory articles, such as salt and pepper, silver, water glass, napkin, etc., must be alike at every meal.
   a. Facilitates the service.
   b. Server may see at a glance whether any article is missing.
   c. Enables patient to find them without trouble.

C. The Linen

1. Tray cover must be clean and uncreased, and of size just to cover the edges of the tray.
2. Napkin must be clean and unwrinkled.

D. The Silver

1. Must be bright.

E. The China

1. Must be free from chips and cracks.
2. Should be of one pattern and of delicate design. A collection of odd pieces gives an untidy appearance to tray.
3. Dishes for hot food should be warmed. Those for cold food should be chilled.

F. Arrangement of Tray

1. The cover.
   a. Plate directly in front of patient.
   b. Knife, cutting edge in, to right of plate.
   c. Teaspoons, bowls up, next to knife.
   d. Bouillon spoon, bowl up, above plate, handle parallel to front edge of tray.
   e. Fork, tines up, to left of plate.
   f. Glass above knife.
   g. Napkin at left side of tray, unless balance is better achieved otherwise.
2. Other dishes.
   a. Bread and butter plate upper left-hand corner.
   b. Cup and saucer at right of spoons.

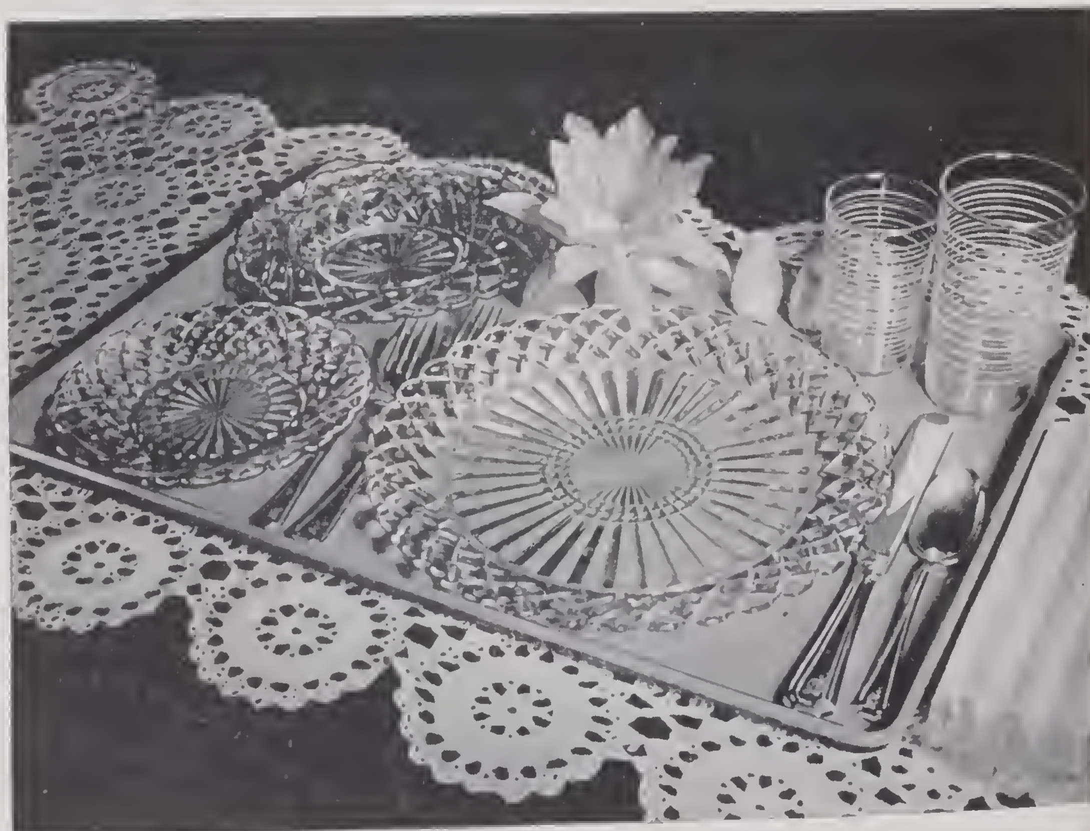


Fig. 88.—Properly set trays. (Courtesy of Dr. Jerome H. Leadley, Rochester, N. Y.)

c. Sugar bowl and salt and pepper shakers in upper right-hand corner.
d. Cream pitchers below these.
e. Fruit plate for breakfast lower left-hand corner.
f. Cereal dish for breakfast directly in front of the patient.
g. Egg cup above cereal dish.
h. Bouillon cup and saucer for supper lower left-hand corner.
i. Vegetable and dessert dishes above plate.
j. Cover over hot food. Do not cover cold food, such as a salad, when it is served as a main dish.

G. General Rules

1. Avoid serving too many things or too large portions. Patient will often eat more food if it is served in courses.
2. See that food is properly seasoned and of right temperature before serving. Hot food should be served hot; cold food, cold.
3. When fluid foods are given, avoid using the same receptacles which are used for medicines, for the association of ideas may be strong enough to destroy the patient's appetite. Fill cups and glasses to within one inch of the top. For drinks to be served alone, use a small tray or plate, covered with a doily or folded napkin.
4. Food should not be allowed to stand in the sick room, and the dishes in which food has been served should be removed from sight as soon as patient finishes with them. Avoid hurrying the patient.

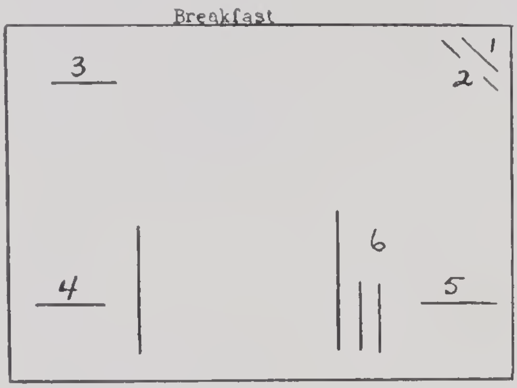
II. Demonstration

A. Standard Set-Up for Three Trays

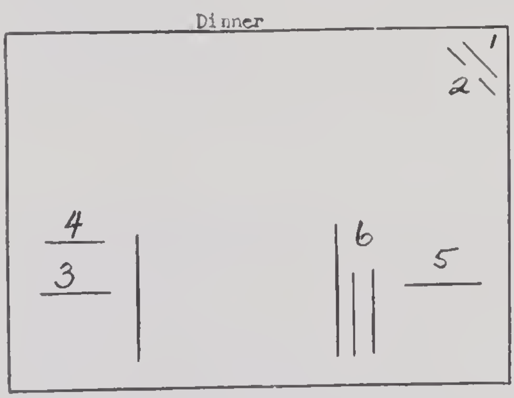
Morning	*Noon*	*Night*
Tomato juice	Meat	Soup
Dry cereal	Potato	Entrée
Cream	Vegetable	Salad
Sugar	Bread	Bread
Egg	Butter	Butter
Bread	Salt	Salt
Butter	Pepper	Pepper
Salt	Dessert	Dessert
Pepper	Tea	Tea
Coffee	Milk	Milk
Water	Sugar	Sugar

1. The items of food for noon and night may be selected from the patients' menu of the day, if practicable.

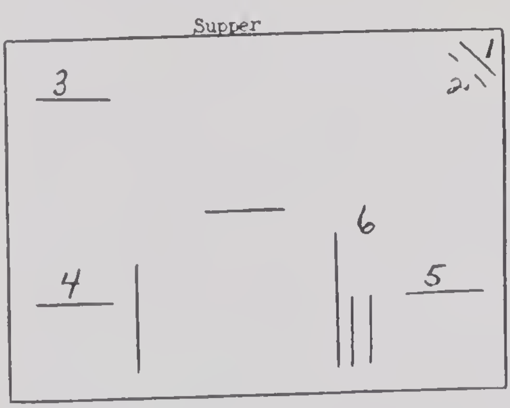
Setting of Trays by Maid



1. Sugar bowl
2. Salt and pepper
3. Bread and butter plate
4. Fruit plate
5. Coffee cup and saucer
6. Silver
   Knife
   Fork
   2 Teaspoons

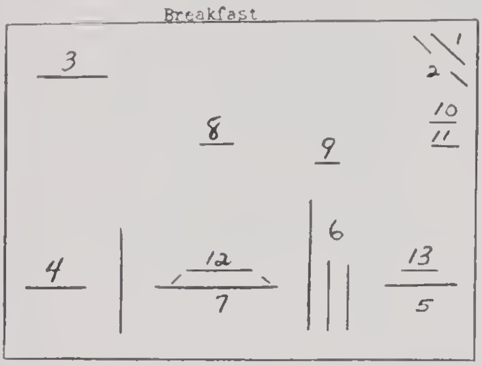


1. Sugar bowl
2. Salt and pepper
3. Bread and butter plate
4. Napkin
5. Tea cup and saucer
6. Silver
   Knife
   Fork
   2 Teaspoons

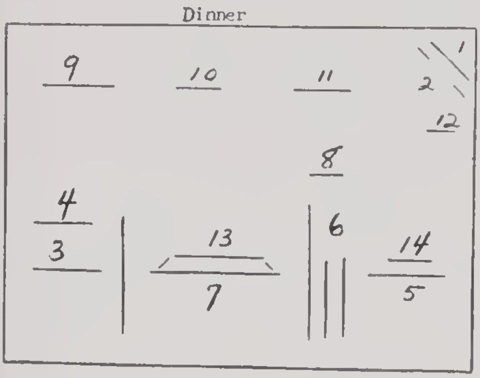


1. Sugar bowl
2. Salt and pepper
3. Bread and butter plate
4. Bouillon saucer
5. Tea cup and saucer
6. Silver
   Knife
   Fork
   2 Teaspoons
   Bouillon spoon

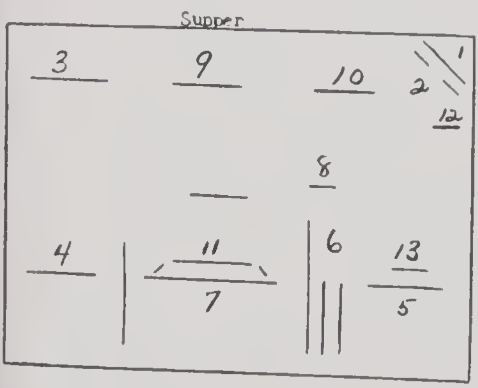
Completion of Tray by Nurse



1. Sugar bowl
2. Salt and pepper
3. Bread and butter plate
4. Fruit plate
5. Coffee cup and saucer
6. Silver
   Knife
   Fork
   2 Teaspoons
7. Cereal bowl
8. Egg cup
9. Glass
10. Cereal creamer
11. Coffee creamer
12. Cover
13. Coffee pot



1. Sugar bowl
2. Salt and pepper
3. Bread and butter plate
4. Napkin
5. Tea cup and saucer
6. Silver
   Knife
   Fork
   2 Teaspoons
7. Dinner plate
8. Glass
9. Salad plate
10. Vegetable dish
11. Dessert dish
12. Creamer
13. Cover
14. Tea pot



1. Sugar bowl
2. Salt and pepper
3. Bread and butter plate
4. Bouillon cup and saucer
5. Tea cup and saucer
6. Silver
   Knife
   Fork
   2 Teaspoons
   Bouillon spoon
7. Supper plate
8. Glass
9. Salad plate
10. Dessert dish
11. Cover
12. Creamer
13. Tea pot

Review Questions

Why is attractive tray service important?

What elements enter into attractive tray service?

Lesson 3. Demonstration. Cereals and Toast

Supplies

¼ c. Fine cereal
Salt
2 Slices bread, ½ inch thick
2 Slices bread, ⅛ inch thick
2 Pats butter

Class Supplies

Samples in glass of: Barley, Rice, Puffed wheat, Macaroni or Spaghetti, Corn meal, Crackers, Loaf sugar, Lactose, Maple syrup, Honey

Staple supplies plus:
Steamed rice
Finely milled cereal
Milk
Cream
Eggs
Raisins
Molasses

Equipment

1 Utility tray
1 Cooking spoon
1 Set measuring spoons
1 Case fork
2 Measuring cups
1 Small baking pan
1 Double boiler

Unit II. Foods High in Energy Value

Lesson 3. Foods Rich in Carbohydrate

Cereals and Toast. Cereal and Cornstarch Puddings

I. Exhibit: Various cereals and cereal products
Various sugars

II. Demonstration—Cereal. Toast and croutons

A. Cereals

1. Purpose of cooking: To soften the cellulose, and to change the starch from an insoluble to a colloidal form. This improves the flavor and renders it more easily digested.
2. Method of cooking: Steaming or cooking in a double boiler, because moist heat and a temperature of 212° F. are necessary.
3. General directions. Pour cereal slowly into boiling salted water, stirring constantly. Continue stirring and cook over direct heat for 3 minutes, or until it begins to thicken. Place over boiling water and cook the required time. See following tabulation.
4. Table for cooking cereals (two servings):

Kind	*Quantity*	*Water*	*Salt*	*Time*
Finely milled	¼ c.	1 c.	¼ tsp.	½ hr.
Rolled or flaked	⅓ c.	1 c.	¼ tsp.	½ hr.
Macaroni, etc.	1 tbs.	1 c.	¼ tsp.	½ hr.
Corn meal	⅛ c.	1 c.	¼ tsp.	1 hr.
Rice	⅛ c.	1 c.	¼ tsp.	1 hr.
Whole grains	¼ c.	1 c.	¼ tsp.	2 hr.

5. Cereal gruels.
Thin any well-cooked cereal with milk or cream. Strain and serve hot.
6. Cereal waters.
Thin any well-cooked cereal with water. Strain and serve hot.
NOTE: Cereal gruels or cereal waters may be chilled and served as cereal jellies.
7. Preparation of ready-cooked cereals: To restore crispness, place in a pan in a warm oven or in a skillet on top of stove, stirring to prevent burning.

B. Toast

1. Purpose of toasting bread: To dry out the moisture and to change the starch on the surface to dextrin. This improves the flavor and makes it easier to digest.
2. Method: Cut bread in slices ⅛ to ½ inch thick, according to use. Cut off crusts before toasting if desired without crusts. Toast under the broiling oven of a gas stove or in an electric toaster only until both sides are an even golden brown color.

a. Dry.
Toast bread cut ¼ to ½ inch thick. Cut slices across diagonally. For toast points cut twice diagonally. For sippets cut in three strips vertically.

b. Buttered.
Cream the butter. *Do not melt.* Spread on hot triangles of toast.

c. Cinnamon.
Sprinkle hot buttered toast with granulated sugar to which cinnamon has been added in the proportion of ½ tsp. cinnamon to ¼ c. sugar.

d. Melba.
Cut bread in ⅛ inch slices. Dry until it curls and bake in a moderate oven (325° F.) until a light brown.

e. Croutons.
Cut dry bread into ½ inch cubes after removing crusts. Bake in a slow oven (300° F.) for 15 to 20 minutes or until a light brown. Stir occasionally.

III. Class Work

A. Cereal Puddings

Creamy Rice Pudding (2 servings)

Temperature 300° F.	Time 2 hours
1 c. milk	¼ tsp. salt
1 tbs. rice	1 tbs. sugar
Little grated lemon rind	

Wash rice. Mix ingredients and pour into buttered pudding dish. Bake to creamy consistency, stirring occasionally at first to prevent rice from settling.

Rice Custard Pudding (2 servings)

Temperature 350° F.	Time ½ hour
¼ c. cooked rice	¼ tsp. salt
1 c. scalded milk	2 tbs. sugar
1 egg	¼ tsp. vanilla

Add milk to rice. Beat egg. Add sugar, salt, and vanilla. Blend mixtures. Pour into custard cups set in hot water. Bake until set.

Bread Pudding (2 servings)

Temperature 350° F.	Time ½ hour
½ c. diced stale bread	2 tbs. sugar
1 c. scalded milk	¼ tsp. salt
1 egg, beaten	Speck of spice

Soak bread in milk. Combine eggs, sugar, salt, and spice, and stir into bread mixture. Pour into baking dishes set in hot water, and bake until set.

Chocolate Bread Pudding

Add 1 tbs. sugar and 1 oz. (3 tbs.) of melted chocolate to the Bread Pudding recipe.

Raisin Bread Pudding

Add ¼ c. raisins, scalded with boiling water, to the Bread Pudding recipe.

Cereal Pudding (2 servings)

Temperature 300° F.	Time 1 hour
½ c. fine cereal	2 tbs. molasses
1 c. scalded milk	¼ tsp. salt
½ tbs. butter	

Add cereal to scalded milk gradually. Add remaining ingredients. Pour into buttered baking dish and bake, stirring occasionally.

B. Cornstarch Puddings

Blanc Mange (2 servings)

Temperature 212° F.	Time 20 minutes
1½ tbs. cornstarch	1 c. milk
2 tbs. sugar	¼ tsp. vanilla

Mix sugar and cornstarch. Add cold milk gradually. Cook over hot water 10 minutes, stirring constantly until smooth and thick. Cook for 10 minutes longer, stirring occasionally. Add vanilla and pour into cold wet custard cups, and chill until firm. Unmold and serve with cream, soft custard, chocolate sauce, fruit sauce, or fresh fruit.

Chocolate Blanc Mange

Add 1 tbs. sugar and blend 2 tbs. cocoa with sugar and cornstarch, or 1 oz. (3 tbs.) melted chocolate with milk to recipe for blanc mange.

C. Review coffee and tea

D. Setting the cover

E. Judging products prepared

IV. Assignment

Each student to compute the caloric value of the following:

1 slice toast ------ plus 1 tbs. jelly ------ = ------ calories
½ c. cereal ------ plus 2 tsp. sugar ------ = ------ calories
1 c. coffee ------ plus 1 tsp. sugar ------ = ------ calories

Review Questions

Why is it necessary to cook cereals?
What type of heat is used? What temperature?
What is the purpose of toasting bread?
What is the standard for good toast? How should it be buttered?

Lesson 4. Demonstration. Muffins

Supplies

2 c. White flour
4 tsp. Baking powder
2 tbs. Sugar
½ tsp. salt
1 Egg
1 c. Milk
2 tbs. Butter

Equipment

1 Set muffin tins
1 Mixing bowl
1 Flour sifter
1 Mixing spoon
1 Set measuring spoons
1 Measuring cup
1 Utility tray

Class Supplies

Staple supplies plus:
Eggs
Milk
Butter
Whole wheat flour
Corn meal

Unit II. Foods High in Energy Value, Cont'd

Lesson 4. Foods Rich in Carbohydrates, Cont'd

Batters and Doughs, Leavening Agents, Muffins

I. Discussion

A. Batters

1. Batter is a mixture of liquid and dry ingredients which can be beaten.
2. Three types:
   a. Thin: Equal parts liquid and dry ingredients.
      Example: Griddle cakes, waffles, popovers.
   b. Pouring: 1 Part liquid to 1½ parts dry ingredients.
      Example: Cake and muffins.
   c. Thick: 1 part liquid to 2 parts dry ingredients.
      Example: Drop cookies.

B. Doughs

1. Dough is a mixture of liquid and dry ingredients which can be kneaded or molded.
2. Two types:
   a. Soft: 1 part liquid to 3 parts dry ingredients. Example: Baking powder biscuits, rolls.
   b. Stiff: 1 part liquid to 4 parts ingredients. Example: Bread, rolled cookies, pastry.

C. A leavening agent is a substance which by mechanical, chemical, or physical means produces bubbles of gas or air in a batter or dough, thus "raising" it. The appearance and palatability of the product are thereby increased.

1. Mechanical:

   Air is incorporated by beating or folding.

2. Chemical:

   Carbon dioxide gas is produced when an acid reacts with an alkali in the presence of moisture and heat. An example of this type is baking powder, where sodium bicarbonate reacts with cream of tartar or other acid, such as sour milk or molasses.

3. Physical:

   Steam is produced when heat changes moisture to the gaseous state. *Yeast* is a microscopic plant. Moisture, warmth, food, and a temperature of from 70° to 90° F. are necessary to its growth. Bread dough provides these conditions. During the growth process alcoholic fermentation of sugar takes place and *carbon dioxide gas* is evolved. Baking drives off the alcohol and stiffens the gluten of the flour, thus holding the gas bubbles. Yeast is used as a leavening agent for slow rising breads but not for quick breads.

II. Demonstration

A. Muffins. General directions:

1. Light oven and regulate temperature.
2. Grease heated muffin tins.
3. Measure, mix, and sift dry ingredients.
4. Add beaten egg, milk, and butter.
5. Blend only until dry ingredients are moistened. Mixture should not be smooth.
6. Half fill the muffin tins and bake immediately in a hot oven at 400° F. for 20 to 30 minutes, or till they shrink from sides of pans.

B. Standard

Muffins should double their size in baking. They should have a rounded top; the crust should be golden brown and tender; the crumb should be moist and should have small even air bubbles.

III. Recipes

A. Muffins

1. **Plain Muffins** (6 muffins)

1 c. white flour	1 egg
2 tsp. baking powder	½ c. milk
¼ tsp. salt	1 tbs. melted butter

1 tbs. sugar

2. **Whole Wheat Muffins** (6 muffins)

⅓ c. whole wheat flour	1 tbs. sugar
½ c. white flour	1 egg
2 tsp. baking powder	½ c. milk
¼ tsp. salt	1 tbs. melted butter

3. **Corn Meal Muffins** (6 muffins)

¼ c. corn meal	1 tbs. sugar
½ c. white flour	1 egg
2 tsp. baking powder	⅓ c. milk
¼ tsp. salt	1 tbs. melted butter

B. Popovers (6 popovers)

½ c. flour	½ c. milk
¼ tsp. salt	1 egg, beaten

Mix and sift flour and salt. Combine eggs and milk, and add to flour mixture gradually. Beat with rotary egg beater until batter is smooth. Half fill hissing hot buttered muffin tins and bake at 450° F. for about 20 minutes, then reduce heat to 350° F. and continue baking for 15 or 20 minutes, or until crust is firm.

Popovers should double their size in baking; they should have a crisp golden crust and a hollow inside, which should be moist but not soggy.

IV. Class Work

A. Muffins and popovers
B. Review coffee and setting the cover
C. Judging products prepared

V. Assignment

Each student to compute the caloric value of the following:

1 muffin ------ plus 1 tbs. jelly ------ = ------ calories
1 popover ------ plus 10 gm. butter ------ = ------ calories

Review Questions

What is a leavening agent?

Complete the following sentences:

1. ---------------- is a mechanical leavening agent.
2. When an acid reacts with an alkali, ------------ is produced. This is a ------------ leavening agent.
3. ---------------- is produced when heat changes moisture to the gaseous state. This is a ---------------- leavening agent.
4. What is yeast? What conditions are necessary for its growth?

What type of batter is used in making muffins?

Describe a perfect muffin.

Lesson 5. Demonstration. White Sauce, French Dressing

Supplies

1 c. Milk
1 tbs. Butter
1 tbs. Flour
1 c. Salad oil
½ c. Vinegar
Paprika

Equipment

1 Saucepan
1 Double boiler
1 Cooking spoon
1 Measuring cup
1 Set measuring spoons
1 Mixing bowl
1 Egg beater
1 Preserving jar

Class Supplies

Staple supplies plus:
Milk
Eggs
Butter
Salad oil
Vinegar or
Lemons
Chili sauce
Stuffed olives
Whipping cream

Unit II. Foods High in Energy Value, Cont'd

Lesson 5. Foods Rich in Carbohydrate and Fat

Cream Sauces, Salad Dressings

I. Demonstration

A. **White Sauces**

1. Proportions	Butter	Flour	Milk	Salt
a. Thin	1 tbs.	1 tbs.	1 c.	¼ tsp.
b. Medium	2 tbs.	2 tbs.	1 c.	¼ tsp.
c. Thick	3 tbs.	3 tbs.	1 c.	¼ tsp.

a. For cream soups.
b. For creamed and scalloped dishes.
c. For soufflés.

2. Procedure:
   a. Measure butter and place in top of double boiler.
   b. When melted, remove from heat and add flour and seasoning, stirring until smooth.
   c. Add milk slowly, stirring constantly.
   d. Return to heat, continue stirring, and cook until it begins to bubble and is thickened.
   e. Place over hot water until ready to use, stirring occasionally.
3. Principle: The flour acts as a thickening agent and also a binder, holding the fat globules in suspension. As with cereals, the cooking softens the cellulose and changes the starch from an insoluble to a colloidal form.

B. **French Dressing**

1 c. salad oil
½ c. vinegar or
lemon juice
¼ tsp. salt
speck of pepper
½ tsp. paprika

Mix ingredients and beat with a rotary egg beater, or shake thoroughly in a covered preserving jar. Cheese, chopped olives, or catsup may be added to make cheese, olive, or tomato dressing.

French dressing has no binder to hold the fat globules in suspension, and, therefore, must be shaken or stirred again immediately before serving.

II. Class Work

A. Each student to make once the recipe of thin white sauce.
B. Working in groups of two, students to make mayonnaise dressings.
   1. **Mayonnaise** (1¼ cups)

1 egg yolk
1 c. salad oil
2 tbs. vinegar
or lemon juice
1 tsp. mustard
1 tsp. salt
1 tsp. powdered sugar
¼ tsp. paprika

Beat egg well, add oil gradually, beating constantly. As mixture thickens, thin with acid. Add oil and acid alternately until all is used. (If oil is added too rapidly, dressing may curdle. A smooth consistency may be restored by adding curdled mixture to another beaten egg yolk.) Mix dry ingredients and add last.

2. **Whipped Cream Dressing.**
   Add ½ c. whipped cream to ½ c. mayonnaise.

3. **Russian Dressing.**
   Add ½ c. chili sauce to 1 c. mayonnaise.

4. **Thousand Island Dressing.**
   Add ¼ c. chili sauce and ¼ c. chopped stuffed olives to 1 c. mayonnaise.

III. Judging products prepared

IV. Assignment

Students to compute the caloric value of the following:

1 slice toast ------ plus 2 tsp. butter ------ = ------ calories
½ c. oatmeal ------ plus 2 oz. 20% cream ------ = ------ calories
½ c. macaroni ------ plus ¼ c. white sauce ------ = ------ calories
½ c. cornstarch pudding ------ plus 1 oz. 40% cream ------ = ------ calories
⅛ head lettuce ------ plus 1 tbs. mayonnaise ------ = ------ calories
½ c. carrots ------ plus ¼ c. white sauce ------ = ------ calories
1 c. coffee ------ plus 1 oz. 20% cream ------ = ------ calories

Review Questions

What ingredients are used in making cream or white sauce?

What proportions of these are used in making "medium" white sauce?

In what way is the making of white sauce similar to cereal cookery? In what way does it differ?

How does French salad dressing differ from mayonnaise?

Lesson 6. Demonstration. Egg Cookery

Supplies

8 Eggs
1 pt. Milk
6 pats Butter
1 tbs. Flour
1 bunch Parsley
2 slices Bread
Salt
Pepper
Junket tablets

Class Supplies

Staple supplies plus:
Eggs
Milk
Butter
Vinegar
Bread
Parsley

Equipment

1 Utility tray
1 Double boiler
3 Tablespoons
1 Set measuring spoons
1 Measuring cup
1 Case knife
1 Vegetable knife
3 Small saucepans
2 Covers for saucepans
2 Small sauté pans
1 Fruit saucer
1 Skimmer
3 Mixing bowls
2 Egg beaters
1 Egg cup
1 Saucer
6 Salad plates

Unit III. Foods High in Protein

Lesson 6. Milk and Eggs

Eggs, Custards, Cooked Salad Dressing, Junket

I. Demonstration

A. **Custards**

1. Ingredients.

1 egg
1 c. milk
2 tbs. sugar
spk. salt
¼ tsp. vanilla

2. Directions.

a. Soft cooked custard (approx. 1 c.).

Beat egg, add sugar, salt, and the milk. Strain into double boiler. Do not allow water in lower part of the double boiler to touch bottom of upper part or the cooking temperature will be too high. Cook, stirring constantly, for about 5 minutes, or until mixture coats a metal spoon. Remove at once from heat, cool quickly, and add vanilla. Soft custard should be smooth and glossy. If cooked too long or at too high a temperature, mixture will curdle. Vigorous beating may improve the appearance, but a curdled custard is never perfect.

Soft custard may be eaten as a dessert or used as a sauce for gelatin desserts or pudding, or as a base for French ice creams.

b. Baked custard (3 custards). Temperature 350° F. Time 25 to 30 minutes.

Prepare as for soft cooked custard. Pour into custard cups. Sprinkle top with a dash of nutmeg. Set cups in a pan of hot water and bake until firm. If water reaches boiling point or custard is cooked too long, it will curdle. The custard is done when a knife blade, inserted, comes out clean, it puffs on top or when shaken is firm like jelly.

B. **Junket** (3 servings)

½ Junket tablet
1 tbs. cold water
1 c. milk
1 tbs. sugar
¼ tsp. vanilla

Crush the tablet and dissolve in cold water. Heat milk until just lukewarm. Remove from fire, add sugar and vanilla, and stir until dissolved. Add dissolved junket tablet and pour at once into individual serving dishes. Let stand in warm room until it sets; then chill.

C. Eggs

1. Coddled.

Have ready a saucepan of boiling water. Allow 1 pt. water per egg plus 1 c. for each additional one. Carefully put in egg with spoon. Cover closely and turn out flame so that water will not continue to boil. Coddle from 6 to 8 minutes for soft cooked, or from 40 to 45 minutes for hard. A 6 to 8 minute coddled egg compares with a 3 to 4 minute boiled egg; one coddled 40 to 45 minutes, with a 10 minute boiled egg.

2. Poached.

Have ready a sauté pan two-thirds full of boiling water. Break egg into a saucer and carefully slip it into a hollow of water formed by stirring in a circular motion. Reduce heat and cook at simmering temperature to desired consistency. Remove carefully with skimmer to pieces of buttered toast.

3. Scrambled

1 egg	speck of salt
1 tbs. milk or cream	1 tsp. butter

Beat egg only until well mixed. Add salt and milk. Melt butter in sauté or saucepan, and cook over low heat or boiling water until of creamy consistency, scraping from bottom and sides of pan with side of spoon. If cooked too long or at too high heat, scrambled eggs will curdle.

4. Buttered.

Heat sauté pan. Put in 1 tbs. butter. When melted, slip in egg, broken into a saucer, and cook gently until white is firm. Turn it over once while cooking if desired.

5. Fried.

Fried eggs are cooked as buttered eggs, except pork, ham, bacon, or vegetable fat is used in place of butter. In this case more fat is used and may be dipped with a spoon and poured over the egg while cooking.

6. Omelets.

a. French.

1 egg	speck of salt
1 tbs. milk	1 tsp. butter

Beat egg slightly, add milk and salt. Turn into a heated buttered sauté pan, which is clean and smooth. Set over low heat, and as it cooks draw cooked portion toward handle; elevate pan slightly, allowing uncooked portion to run down to front of pan; continue to draw back until all is cooked. When delicately

browned on bottom, roll and serve at once. Before rolling, 1 tbs. chopped meat, cheese, vegetable, or jelly may be added.

b. **Foamy.**

2 eggs
2 tbs. milk
speck of salt
2 tsp. butter

Separate eggs and beat whites to a stiff froth. Beat yolks until lemon colored. Add milk and salt. Fold in whites with a quick light motion. Put butter into heated sauté pan and allow it to melt over entire surface. Add egg mixture. Move pan gently over heat. When delicately browned, place in a hot oven for a moment to complete cooking. Fold omelet half over and turn onto a hot dish. Garnish and serve immediately.

7. **Shirred or baked.** Temperature 350° F. Time approx. 15 min.

Butter individual ramekins; break an egg into each and season with salt and 1 tbs. cream (or milk). Bake until white is firm. Serve in ramekin.

8. **Creamed.**

To ½ c. medium white sauce, add 1 sliced or chopped hard cooked egg. Season with salt. Serve on toast points and garnish with a dash of paprika.

9. **Goldenrod.**

To ½ c. medium white sauce, add the chopped white of 1 hard cooked egg. Serve on toast and sprinkle with the yolk forced through a purée sieve with the back of a spoon. Garnish with parsley and serve at once.

II. Principle of Cookery of Eggs

Eggs should be cooked at low temperatures. The proteins coagulate at temperatures ranging from 140° to 160° F. Higher temperatures may make them tough and less quickly digested.

III. Class Work

1. Preparation of soft and baked custards.
2. Cooking of eggs as assigned.
3. Cooked salad dressing (approx. 1 pt.).

3 tbs. sugar
3 tbs. flour
1 tsp. salt
1 tsp. mustard
speck of paprika
2 eggs
3 tbs. butter
1½ c. milk
½ c. vinegar

Mix dry ingredients, add eggs, slightly beaten, butter, milk, and vinegar very slowly. Cook over boiling water until mixture thickens, stirring constantly. Remove immediately from fire, strain and cool.

IV. Judging and serving of products prepared.

Review Questions

What ingredients are used in making custards?
What ingredient in a junket tablet predigests milk?
State reasons for using low temperatures in egg cookery.
How is the temperature kept low in making soft custard? Baked?

Lesson 7. Demonstration. Meat and Fish Broths

Supplies

1 lb. Lean beef ground
6 Clams in shell
1 pt. Prepared beef broth
1 bx. Bouillon cubes
1 jar Beef extract

Class Supplies

Staple supplies plus:
Oysters
Oysterettes
Soda crackers
Canned tomatoes
Mixed vegetables
Meat stock
Spaghetti
Store cheese
Light cream
Milk
Butter
Eggs
Bread

Equipment

1 Crockery plate
1 Sharp knife
1 Potato ricer
2 Cups and saucers
2 Bouillon spoons
1 Double boiler bottom
1 Saucepan with cover
1 Sauté pan
1 Tablespoon
1 Case knife
1 Quart preserving jar

Unit III. Foods High in Protein, Cont'd

Lesson 7. Meat and Fish Broths. Cheese Dishes

I. Demonstration

A. **Beef Tea** (approx. 1 pt.)

1 lb. lean beef   1 pt. cold water   ½ tsp. salt

Place the finely ground beef in a preserving jar. Add the cold water and let stand for one hour. Place the jar in a saucepan of cold water with a cloth in the bottom, and heat the wator slowly to simmering. Keep at that temperature for two hours. Do not let it boil. Then slowly increase the heat sufficiently to turn the beef to a deep chocolate color. Add the salt. Strain through cheesecloth. Never allow to boil either in making or in reheating. Concentrated beef extract (¼ tsp. to 1 bouillon cup of hot water) is an acceptable substitute.

B. **Meat Broth or Stock** (prepared in advance)

2 lbs. lean meat   ½ tsp. sweet horbs
1¼ qt. cold water   ½ tsp. salt
½ tbs. each of carrot, onion, and celery, chopped

Cut meat into pieces, add the seasonings and cold water, and let stand ½ hour. Heat slowly and let simmer for 5 or 6 hours. Add vegetables, cook another hour, strain and cool quickly. Bouillon made from cubes (1 cube to 1 bouillon cup of water) is an acceptable substitute.

C. **Clam broth**

6 clams in shell   salt
1 c. water   paprika

Choose large clams. Scrub them thoroughly with a brush, rinse, place in a kettle and cover with cold water. Cover and bring water to boiling point. Remove clams from broth as soon as shells have opened. Let broth settle, and strain. Clam broth may be served hot or cold with a heaping tablespoonful of whipped cream, into which has been beaten a little salt and pepper.

II. Class Work

A. **Soups**

1. **Vegetable Soup** (2 servings)

1½ c. meat stock   ½ c. mixed vegetables

Wash, pare, and dice vegetables. Mix and cook for 10 minutes in 1 tablespoonful butter, stirring to prevent burning. Add meat stock and cook until vegetables are tender. Season with salt and pepper. Serve with Melba toast or crisp crackors.

2. **Oyster Stew** (2 servings)

½ c. oysters	1 c. milk or
speck of salt and pepper	½ c. milk and
2 tsp. butter	½ c. cream

Look over oysters carefully for shells and cook gently in a saucepan, only until the edges curl. Skim, season, and add to the milk which has been heated in the top of a double boiler. Add butter and serve at once with oyster crackers.

B. Cheese Dishes

1. **Baked Spaghetti or Macaroni** (2 servings)

½ c. spaghetti	¼ tsp. salt
1 c. medium white sauce	speck of pepper
¼ c. grated cheese	2 tbs. butter

2 tbs. fine cracker crumbs

Break spaghetti into 1 inch pieces and measure. Cook in 2 c. boiling water for about 15 minutes, or until tender. Drain in a strainer and run cold water through it. Mix spaghetti, cheese, and white sauce, and pour into buttered baking dishes. Cover with crumbs and dot with butter. Bake at 425° F. until brown.

2. **Cheese Fondue** (2 servings)

½ c. milk (scalded)	1 tbs. butter
½ c. bread cubes without crusts	speck of salt
½ c. finely cut American cheese	1 egg

Mix first five ingredients. Add yolk of egg beaten until lemon colored. Fold in egg white, beaten stiff. Pour into buttered baking dishes set in a pan of hot water, and bake at 350° F. for 30 minutes, or until set. Serve immediately.

3. **Welch Rarebit** (2 servings)

2 tbs. butter	¼ tsp. salt
2 tbs. flour	¼ tsp. mustard
1 c. milk	½ c. American cheese (¼ lb.)

2 slices thin dry toast or crackers

Make a white sauce of the first five ingredients. When thickened, set in double boiler, add finely cut cheese, and stir until melted. Keep hot, but do not continue cooking. Pour over toast and add a dash of paprika.

4. **Tomato Rarebit** (2 servings)

2 tbs. butter	¼ tsp. salt
2 tbs. flour	¼ tsp. mustard
½ c. thin cream	½ c. American cheese
½ c. tomato purée	speck of soda

2 slices thin dry toast or crackers

Make a white sauce of flour, butter, cream, and seasonings. Neutralize hot purée with soda and add to white sauce. Set in double boiler, add finely cut cheese, and stir until melted. Serve on toast or crackers.

III. Discussion

A. Soups

Soups with stock are classified as:

1. Bouillon, made from lean beef, delicately seasoned and usually clear.
2. Brown soup stock, made from beef and beef bones, highly seasoned with vegetables, spices, and sweet herbs.
3. White soup stock made from chicken or veal, with delicate seasonings.
4. Consommé, usually made from two or three kinds of meat, highly seasoned with vegetables, spices, and sweet herbs. Always served clear.
5. Lamb stock delicately seasoned is served as lamb broth.

B. Cheese—Classification (show samples)

1. Soft—unripened.
   Cottage, Cream, Neufchâtel.
2. Soft—ripened (by mold or bacteria).
   Brie, Camembert, Liederkranz, Limburger.
3. Semi-hard—ripened.
   American, Brick, Gorgonzola, Münster, Roquefort, Stilton.
4. Hard—ripened (by bacteria).
   Cheddar, Cheshire, Edam, Parmesan, Pineapple, Swiss, Gruyère.

C. Principle of Cookery

Cheese, like other protein foods, is toughened by high temperatures. Moderate temperatures and short cooking times are, therefore, used.

Review Questions

In making beef tea or meat stock why is the meat allowed to stand in cold water before heating?

Is cheese classed as a carbohydrate, fat, or protein food?

Why is a cheese rarebit cooked in a double boiler?

Lesson 8. Demonstration. Fricassee, Roasts, Gravy and Scraped Beef

Supplies

1 lb. Shoulder of veal or beef for stew
1 lb. Round of beef for pot roast
½ lb. Round of beef 1″ thick
1½ lbs. Tenderloin of beef or
1 Rib roast of beef, small
¼ lb. Salt pork
1 qt. Meat stock
1 c. Mixed vegetables (diced)
Flour

Equipment

2 Small baking pans
1 Mixing bowl
1 Cup strainer
1 Tablespoon
1 Teaspoon
2 Measuring cups
1 Skillet
1 Casserole dish with trivet and cover

Class Supplies

Staple supplies plus:
Hamburger
Lamb chops
Tenderloin steaks
Liver
Bacon
Dressed broilers
Sweetbreads (parboiled)
Bread ⅛″ thick
Parsley
Butter
Lemon

Unit III. Foods High in Protein, Cont'd

Lesson 8. Fish, Meats, and Poultry

I. Demonstration

A. **Fricassee of Meat** (use less tender cuts)

Clean and cut up meat. Dredge with flour and salt. Sauté until brown in meat fat, either in a roasting pan in the oven or in a sauté pan on top of the stove. Add meat stock to cover and simmer gently until meat is tender. Add salt and pepper to taste. Mixed vegetables may be added during the last part of cooking. Thicken gravy if desired, by moistening flour with cold water in the proportion of 1 tablespoon flour to each cup of meat stock.

B. **Braised Beef or Pot Roast**

3 lbs. from lower part of round or face of rump
2 thin slices fat salt pork
salt and pepper
¼ c. each—diced carrot, turnip, onion, celery

Try out pork and remove scraps. Wipe meat, sprinkle with salt and pepper, dredge with flour, and brown entire surface in pork fat. When turning meat, avoid piercing with a fork. Place on plate or trivet in a deep granite pan, earthen or glass casserole, and surround with vegetables and 3 cups of hot water or meat stock; cover closely and bake for 4 hours in a slow oven at 350° F. Throughout cooking the liquid should be kept below the boiling point. When meat is tender, remove and thicken gravy by browning flour in skimmed meat fat and adding strained meat stock. (Proportion 1 tablespoon flour, 1 tablespoon fat, 1 cup stock.)

C. **Roast Meat**

Wipe meat with clean damp cloth. Put on rack in dripping pan, sprinkle with salt, and dredge meat and pan with flour. Place in a moderate oven (275° to 300° F. for cured pork; 325 to 350° F. for beef, lamb, fresh pork, or poultry). Baste every 15 minutes with fat, which fries out unless a covered roaster is used. When meat is half done, turn it over and dredge with flour so that underside may be browned. For rare meat allow approximately 20 minutes to the pound; for well done, about 30 to 35 minutes to the pound. The use of a meat thermometer assures uniform results. These register the temperature at the center as follows:

Beef—rare	140° F.
medium	160° F.
well done	170° F.
Veal and cured pork	170° F.
Processed hams	145° to 150° F.
Lamb	175° to 180° F.
Fresh pork	185° F.

D. Meat Gravy

Remove some of the fat from the pan, leaving 2 tablespoons. Add 2 tablespoons flour. Place over heat and stir until well browned. Add gradually 2 cups hot stock or water; stir until it comes to a boil and thickens. Season with salt and pepper if necessary, and strain.

E. Scraped Beef

Wipe ½ pound lean beef from the round and cut into strips. Place on a board and scrape each strip with a silver spoon with the grain of the meat, leaving the connective tissue. Season with salt and serve raw on bread or toast, or form into small patties and broil lightly.

II. Discussion

A. Fish

1. Classification (common varieties).
   a. Low in fat.
      Bass, bluefish, cod, flounder, trout, weakfish.
   b. High in fat.
      Butterfish, halibut, herring, mackerel, salmon, shad, whitefish.
   c. Shellfish.
      (1) Bivalve mollusks.
          Clams, oysters, scallops.
      (2) Crustaceans.
          Crabs, lobsters, shrimps.
2. Selection.
   a. Fresh fish has firm flesh, and bright eyes and gills.
   b. Frozen, dried, or canned fish are entirely acceptable when fresh fish is not available.
3. Care.
   a. Fish should always be closely covered if it is to be put in the refrigerator with other food.

B. Meats

1. Classification.
   Beef, veal, mutton, lamb, pork, poultry.
2. Selection.
   a. Beef.
      (1) Firm and fine-grained.
      (2) Bright red in color.
      (3) Well mottled and coated with fat.
      (4) Fat, firm, and of creamy white color.
      (5) Suet, dry and crumbles easily.
   b. Veal—meat of young calf.
      (1) Pinkish-colored flesh.
      (2) White fat.
   c. Lamb—(six to fourteen months old. Mutton, from older sheep).
      (1) Firm, fine-grained, and bright pink in color.
      (2) Fat, white, hard, and flaky.

d. Pork.
  (1) Firm.
  (2) Pale pink color.
  (3) Fat, hard and white.

e. Poultry.
  (1) Broilers—young chickens up to 1½ pounds.
  (2) Chicken.
  Soft feet, smooth skin, and soft cartilage at end of breast bone. An abundance of pinfeathers indicates a young bird. Presence of long hairs indicates an old bird.
  (3) Fowl.
  Feet have become hard and dry with coarse scales, and cartilage at end of breast bone has ossified.
  (4) Turkey.
  A good turkey should be plump, have smooth dark legs, and the cartilage at end of the breast bone should be soft and pliable.
  (5) Geese, ducks, quail, partridge, pheasants, and squab (young pigeons) are also classed as poultry or game, but are less commonly used.

3. Cuts—see textbooks and charts in Laboratory.

4. Care.
  a. Always remove meat from paper as soon as delivered so that juices may not be absorbed, and place in refrigerator.

5. Cleaning.
  a. Beef.
    (1) Always wipe beef before cooking with a clean cheesecloth wrung out of cold water, but never allow it to stand in water since juices will be drawn out.
  b. Veal, lamb, pork, and poultry.
    (1) Wash in cold water, but do not allow to stand in water. Add bicarbonate of soda to water if any strong odor is detected.

III. Class Work

A. Broiling

1. Meat.
  a. Preheat broiler for 5 to 10 minutes.
  b. Place pan and rack so that meat is 3 inches below gas flame or electric element. Temperature of meat is then 350° F. Lamb chops 1 inch thick may be placed 2 inches from flame. Very thin cuts may be placed closer. When one side is browned, season and turn, cooking to desired degree of doneness.
  c. Remove to hot serving dish, season, spread with soft butter (unless meat is fatty), garnish with cress or parsley, and serve at once.

2. Fish.
   a. Clean and wipe fish as dry as possible, sprinkle with salt and pepper, dot with butter, and place on a well-oiled baking sheet under the broiler as for meat.
   b. When thoroughly cooked, slip from pan to hot plate, garnish, and serve at once.

B. Pan-broiling
   1. Meat.
      a. Heat a sauté pan or griddle sizzling hot.
      b. Put on meat and turn frequently to sear and thus retain the juices.
      c. Lower heat and cook to desired degree of doneness.
      d. Remove to hot serving dish, season, spread with soft butter (unless meat is fatty), garnish with cress or parsley, and serve at once.

C. Broiled Meat (oven-cooked)
   1. Bacon.

Place thin slices of bacon closely together on a broiling rack. Place rack over dripping pan and bake in a hot oven (400° to 450° F.) until bacon is golden brown and crisp, turning once. Pour off liquid fat as it tries out. Drain on brown paper and serve hot.

   2. Broilers.

Young chickens weighing about 1 pound may be split, cleaned, and broiled as for steaks or chops. Older broilers up to 2 pounds may be cooked as follows:

Place broiler on broiling rack, skin side down, sprinkle with salt and pepper, dot with butter, and bake 15 minutes in a hot oven (400° to 450° F.). Then broil to brown and finish cooking.

D. Sauces for fish and meat
   1. **Maître d'hôtel Butter.**

2 tbs. butter	¼ tsp. salt
1 tsp. minced parsley	dash of pepper

1 tbs. scant, lemon juice

Cream butter until soft. Add seasonings and lemon juice, beating till smooth.

   2. **Lemon Butter.**

Make as maître d'hôtel butter, omitting parsley.

IV. Serving and judging of products prepared.

Review Questions

What care should be given meat upon delivery into the kitchen? Fish?

How should beef be cleaned before cooking?

What method may be used for other meats?

For fricassees and pot roasts, is dry or moist heat used in cooking? For roasts, steaks, and chops which is used?

Lesson 9. Creamed and Scalloped Dishes, Soufflés

Class Supplies

Canned or fresh mixed vegetables
Canned corn (whole kernel)
Canned corn (cream style)
Canned peas
Canned (soup) asparagus
Canned tomatoes
Cabbage or cauliflower
Fresh tomatoes
Milk
Butter
Store cheese
Soda crackers or
Dry bread for crumbs
Bread for Melba toast and croutons

Unit IV. Foods High in Minerals and Vitamins

Lesson 9. Creamed and Scalloped Dishes, Soufflés

I. Discussion

A. Creamed Soups

Creamed soups are a combination of thin white sauce and a purée of vegetable or fish (i.e., vegetable or tender fish forced through a strainer and retained in the soup). Half vegetable or white stock is sometimes used for the base of the sauce. Suitable seasonings are added.

B. Creamed and Scalloped Dishes. Soufflés

1. Creamed—fish, meat, eggs, Italian pastes, or vegetables are added to medium white sauce or a modification of it.
2. Scalloped—creamed dishes are placed in baking dishes, covered with buttered bread or cracker crumbs. Grated cheese may be added. They are then browned in the oven. Material may be arranged in layers if desired.
3. Soufflés, fondues, and baked timbales. These are scalloped dishes to which stiffly beaten egg whites have been added to make them light and fluffy. Crumbs are usually omitted. Such dishes should be served immediately upon removing from the oven.

II. Recipes

A. Cream of Vegetable Soup (2 servings)

½ c. vegetable purée
¼ tsp. salt
1 c. thin white sauce
¼ tsp. sugar

Cook vegetables in a small amount of water until tender, or heat canned vegetables. Force through a strainer and add purée to white sauce. Add seasonings and place over hot water until ready to serve. NOTE: For cream of tomato soup add ⅛ teaspoon soda to the hot purée, and add gradually to the white sauce. Serve immediately.

B. Creamed Vegetables (2 servings)

Add diced mixed vegetables (fresh or canned) to medium white sauce in the proportion of ½ cup sauce to 1 cup of vegetables. Sauce may be made of half milk and half vegetable stock (the water in which the vegetables were cooked).

C. Scalloped Cabbage or Cauliflower (2 servings)

Cabbage or cauliflower, ⅛ medium-sized head
½ c. medium white sauce
2 tbs. cracker crumbs
2 tsp. butter

Wash vegetable and soak for ½ hour in cold salted water. Shave cabbage or break cauliflower into flowerets. Cook until tender and drain. Place in a buttered baking dish. Pour the sauce over it. Cover with crumbs and bake in a moderate oven (375° F.) until brown.

D. Corn Pudding (2 servings)

Temperature 375° F. Time 30 to 40 minutes.

½ c. canned corn	1 c. milk
1 egg	½ tsp. salt
½ tbs. sugar	1 tbs. melted butter

Drain off liquid from corn (freshly cooked corn may be used). Beat the egg slightly, add sugar, milk, salt, butter, and corn. Turn into buttered baking dishes, set in a pan of hot water, and bake until set like custard.

E. Corn and Tomato Casserole (2 servings)

1 tbs. butter	½ c. cooked corn
1 tbs. flour	1 medium-sized tomato
½ c. milk	buttered bread crumbs
¼ tsp. salt	2 tbs. grated cheese

speck of pepper

Make a white sauce of the first five ingredients. Place alternate layers of corn, white sauce, and sliced tomato, sprinkled with salt, in buttered baking dishes. Cover with crumbs mixed with cheese. Bake in a moderate oven (350° F.) until the cheese is melted and the mixture is heated through.

F. Vegetable Souffle (2 servings)

Temperature 325° F. Time 25 minutes.

½ c. thick white sauce	2 egg yolks
½ c. minced cooked vegetables	2 egg whites

Salt and pepper to taste.

Add vegetables to white sauce. To hot mixture add yolks well beaten. Season. When cool add stiffly beaten whites, folding in lightly. Bake in ungreased baking dish set in hot water and bake at 325° F. Serve at once.

III. Class Work

A. Students to prepare soups, creamed and scalloped dishes as assigned.
B. Review Melba toast and croutons.
C. Judging and serving of products.

Review Questions

Describe a cream soup.

How does a soufflé or a fondue differ from a scalloped dish?

Lesson 10. Demonstration. Vegetable Garnishes and Hollandaise Sauce

Equipment

Utility tray
4 Small bowls
1 Vegetable knife
1 Cooking spoon
1 Measuring cup
1 Set measuring spoons
1 Double boiler

Supplies

Young carrots
Fresh celery
Parsley
Fresh radishes
Ice cubes
½ c. Butter
2 Eggs
1 Lemon
Salt
Cayenne pepper

Class Supplies

Staple supplies plus:
Fresh tomatoes
New or canned carrots
New or frosted peas
Cabbage or cauliflower
Fresh or frosted spinach
Fresh or frosted asparagus
Cottage cheese
Cream cheese
Eggs
Whole wheat bread
White bread
Lemons
Oranges (for juice)
Canned apricot juice
Canned grapefruit juice
Stuffed olives
Sardines
Shrimp
Chili sauce
Parsley
Milk
Light cream
Butter
Cocoa or chocolate syrup
Small crackers

Unit IV. Foods High in Minerals and Vitamins, Cont'd

Lesson 10. Vegetables, Canapés, Cocktails, Sandwiches

I. Exhibit of foods that are good sources of calcium, phosphorus, and iron

II. Discussion

A. Vegetables

1. Classification.

a. Legumes, as peas, beans, and lentils.
b. Roots and tubers, as beets, turnips, potatoes.
c. Green vegetables, as lettuce, spinach, celery.
d. According to carbohydrate content.

2. Composition.

All vegetables have a high percentage of water, and with the exception of legumes, a relatively small proportion of protein. The chief nutrients are carbohydrates. The fats are usually small in amount and chiefly in the form of oils. A variety of minerals and vitamins is present.

3. Structure.

The framework of vegetables is cellulose, a tough, woody fiber which does not digest and is not a food.

4. Food value.

Vegetables when in season are a very economical item of food, and are always a very necessary part of the diet. The cellulose gives bulk. They are also valuable for their minerals and vitamins, and serve to give variety to the diet.

5. Useful parts.

Different parts of different plants are used as food.

Roots—beets, radishes, sweet potatoes, turnips, carrots.

Tubers—potatoes, Jerusalem artichokes.

Bulbs—chives, onions, garlic, shallots, leeks.

Leaves—Brussels sprouts, greens, lettuce, endive, cabbage, chard, chicory, cress.

Fruit—cucumbers, tomatoes, egg plant, squash, pumpkin, okra, peppers.

Seeds and Pods—corn, peas, beans, lentils.

Stems—Asparagus, celery, kohlrabi, rhubarb.

Flowers—broccoli, cauliflower, French artichokes.

6. Selection.

Select vegetables free from blemishes and of medium size. They are cheaper because more come in a given measure, and better, since the large vegetables are sometimes old and tough and poor in flavor.

7. Care.

Winter vegetables, with the exception of squashes, should be kept in a cold place and packed in barrels or bins to exclude air. Summer vegetables should be cooked as soon as possible after they are gathered. Fresh vegetables are of much better flavor than those which have been picked long before use.

8. Preservation (discuss methods).
   a. Storage.
   b. Commercial and home canning.
   c. Refrigeration.
   d. Quick freezing.

III. General directions for preparing and cooking vegetables

A. Select vegetables of equal size.

B. Wash them thoroughly, and pare, scrape, peel, shell, or string.

EXCEPTIONS: Potatoes may be cooked with the skins on. Beets should have skins and one inch of top left on.

C. Drop into cold water as soon as prepared, to crisp and prevent discoloration. Long soaking results in loss of mineral and starch content.

D. Drop them into freshly boiling salted water, allowing ¼ teaspoon salt to each cup of water, cover, and cook only till tender. Use only enough water to prevent burning so that none is left to drain off. Steaming in place of boiling also conserves the nutritive value.

NOTE: Strong-flavored vegetables may be cooked in a large amount of water, in an uncovered vessel, to prevent disagreeable odor during cooking, to diminish the strong taste of vegetables, and (for some people) to make them more easily digested.

Dried vegetables—pick over, wash, and soak in cold water several hours before cooking, or preferably over night or all day. Cook in same water.

E. Season with salt, pepper, and butter; white sauce; cream; or vinegar, and serve promptly.

IV. Timetable for boiling vegetables.

Vegetable	*Approximate Time Minutes*
Asparagus	10-20
Beans, green, fresh	15-30
Beans, Lima	20-40
Beet greens	15-25
Beets, new	30-60
Beets, old	60-120
Broccoli	10-30
Brussels sprouts	10-15
Cabbage	5-15
Carrots, new	10-20
Carrots, old	20-30
Cauliflower	8-20
Chard, Swiss	10-15
Corn	6-10
Dandelion greens	15-25
Kale	15-25
Kohlrabi	25-35
Onions, white	30-40
Parsnips	20-45
Peas	10-25
Potatoes, sweet	20-30
Potatoes, white	20-40
Rutabagas	20-45
Salsify	20-45
Spinach	8-10
Squash, summer	10-20
Squash, winter	20-25
Tomatoes	5-20
Turnips	15-45

NOTE: For steaming vegetables cook one-fourth to one-third longer time than for boiling.

Frosted vegetables should be cooked the same as fresh vegetables. Follow directions on package for cooking time.

V. Demonstration

A. Vegetable garnishes

1. Carrot sticks.
2. Celery curls.
3. Parsley.
4. Radish roses.

B. Hollandaise Sauce.

½ c. butter
2 egg yolks
1 tbs. lemon juice

¼ tsp. salt
speck of cayenne pepper

Put butter in a bowl, cover with cold water, and wash using a spoon. Divide into three pieces; put one piece in top of double boiler with egg yolks and lemon juice. Place over hot water and cook, stirring constantly until butter is melted. As it thickens add second piece of butter, then third. If mixture curdles, add 2 tablespoonfuls heavy cream. After mixture thickens do not continue cooking.

VI. Class Work

A. Canapés

1. Canapés are a special type of hors d'oeuvres and are served as a first course of luncheon or dinner either alone or to accompany a cocktail.
2. Cut bread in slices ¼ inch thick, remove crusts and cut into strips, squares, diamonds, circular pieces, or other fancy shapes.
3. Toast on one side to a delicate brown.
4. Spread untoasted side with a well-seasoned mixture of eggs, cheese, fish, meat, or vegetables.

B. Food cocktails may be made of a combination of tart fruits or fruit juices, vegetables or vegetable juices, fresh, frozen, or canned fish, well seasoned, and served with lemon and chili sauce.

C. Sandwiches

1. Slice bread as thinly as possible.
2. Cream butter and spread on bread.
3. Spread one slice of bread with filling of well-seasoned eggs, cheese, fish, meat, or vegetables, and cover with another slice. Remove crusts and cut in fancy shapes; or single slices may be spread and rolled.

D. Luncheon Menus

1. Vegetable plate.
   Cottage cheese sandwiches with whole wheat bread.
   Iced orange juice with egg white.
2. Apricot cocktail.
   Spinach mold with deviled eggs (see Lesson 14).
   Bread and butter folds.
   Hot chocolate (see Lesson 15).
3. Shrimp cocktail and Saltines.
   Asparagus on toast—Hollandaise sauce.
   Eggnog (see Lesson 15).
4. Grapefruit juice with cream cheese–olive canapés.
   Grilled tomatoes on toast points with grilled sardines and lemon garnish.
   Coffee.

Grilled Tomatoes

Select medium-sized tomatoes and cut in half crosswise. Sprinkle with salt, pepper, and fine cracker crumbs. Dot with butter. Bake about 20 minutes at 400° F.

VII. Serving and judging of luncheons as to appearance, palatability, and nutritive value.

Review Questions

Name some foods which are important sources of calcium in the diet. Phosphorus? Iron?

What is meant by 5, 10, 15, or 20% vegetables?

State general directions for preparing and cooking vegetables.

Lesson 11. Demonstration. Cooking of Dried Fruits

Preparation of Fresh Fruits

Supplies

6 Prunes
Granulated sugar
Powdered sugar
3 Table oranges
2 Juice oranges
1 Grapefruit
2 Maraschino cherries
⅛ c. Lemon juice
2 Bananas
Additional fruits in season
Crushed ice
Gram scales

Class Supplies

Staple supplies plus apples or rhubarb according to season, and foods assigned to students for weighing.

Equipment

Utility tray
1 Small saucepan
1 Tablespoon
1 Set measuring spoons
1 Vegetable knife
1 Orange borer
1 Long sharp knife
1 Strong fork (pineapple)
1 pr. Kitchen scissors
1 Grapefruit knife
1 Sugar dredger
8 Fruit plates
1 Fruit juice glass and server
1 Sherbet dish
1 Silver fork
1 Silver knife
1 Bowl (berries or grapes)

Unit IV. Foods High in Minerals and Vitamins, Cont'd

Lesson 11. Fruits. The Weighing of Foods

I. Exhibit of raw, canned, dried, and frozen fruits

II. Demonstration

A. Cooking of dried fruits.

1. Look over and wash fruit carefully.
2. Place in saucepan in which it is to be cooked and cover with cold water.
3. Cover saucepan and allow fruit to soak for several hours or overnight.
4. Cook until tender at simmering temperature in the water in which it was soaked.
5. Serve cold.

NOTE: Sugar is not necessary but gives a more glossy appearance to the fruit. For a more tart flavor cook sliced lemon with the fruit.

B. Preparation of fresh fruits.

1. Select fruit which is ripe, since it is sweeter, juicier, of better flavor and more digestible.

NOTE: Use a silver or stainless steel knife for peeling and slicing fruits that discolor easily, and sprinkle with lemon or grapefruit juice. Apples may be dropped in salted water and peaches sprinkled with sugar.

a. Oranges

(1) Peeled

With a sharp knife peel up and over the fruit, cutting just under the white membrane.

(2) Sliced

Lay peeled orange on board, and with a sharp knife cut slices ¼ inch thick. Remove seeds.

(3) Sectioned

With a sharp knife cut sections from a peeled orange, cutting from outside toward center, avoiding membrane.

(4) Halved

Cut unpeeled orange in half crosswise. With small sharp knife cut sections, avoiding membrane.

(5) Juice

Halve small oranges. Squeeze on hand or electric borer. Strain. Serve in small glasses.

b. Grapefruit

(1) Cut in halves crosswise. Remove seeds. With scissors cut around membrane at center. With small sharp knife cut sections, avoiding membrane. Sprinkle with powdered sugar. Add garnish if desired.

(2) Cut in halves crosswise. Remove seeds. With a small, sharp, pointed knife make a cut separating pulp from skin around entire circumference; then make cuts separating pulp from membrane which divides fruit in sections. Remove tough portion in one piece by cutting at stem or blossom end and close to skin. Sprinkle with powdered sugar. Add garnish if desired.

c. Bananas (avoid chilling since it blackens the skin and injures the flavor).

(1) Remove one section of skin. Slice banana in skin with a silver knife. Sprinkle with lemon juice and powdered sugar. Serve with a fork.

(2) Cut banana in halves crosswise, and each half lengthwise. Sprinkle with lemon juice and powdered sugar. Arrange on plate and serve with a fork.

d. Apples, pears, and plums should be wiped, polished, and chilled when served whole.

e. Berries

Pick berries over, wash by slipping into a bowl of cold water. Lift out into a colander to drain. Hull if necessary. Chill.

f. Grapes should be washed, cut into proper-sized bunches, and chilled.

g. Melons should be washed, halved or quartered, seeds removed, and served on ice. Do not put ice into melon as it dilutes the flavor.

h. Pineapple

Spines should pull easily from ripe pineapple. Wash fruit. Remove crown. Stand upright on board and with long sharp knife, cut off rind; remove eyes with small pointed knife.

(1) Put strong fork through top and hold firmly. With a silver fork shred pulp from core. Add sugar and chill.

(2) Lay pared pineapple on side and cut in slices. Remove cores.

(3) Chop slices, add sugar and chill.

C. The use of the gram scales.

III. Class Work

A. Each student to section an orange.

B. Cooking of stewed fruits.

1. **Applesauce.**

Wipe, core, pare, and slice tart apples. Cook slowly to a mush with just enough water to prevent burning. Add sugar to taste (about 2 tablespoonfuls for each apple). If desired, strain.

2. **Rhubarb Sauce.**

Peel and cut rhubarb in 1 inch pieces. Add ¼ cup sugar to each cup fruit. Put in a saucepan, and add ⅛ cup water to prevent rhubarb from burning. Cook slowly on top of stove, or in a moderate oven until soft.

NOTE: If rhubarb is covered with boiling water, allowed to stand for 5 minutes, then drained, less sugar will be required in cooking.

C. Practice in the use of the gram scales.

1. Weighing 100 calorie portions of food.

IV. Serving and judging products.

Comparison of calorie values of foods as weighed.

Review Questions

Why are dried fruits cooked in the water in which they are soaked?

What special nutritional value is found in apricots? Prunes? Citrus fruits?

Describe the method of weighing a food on the gram scales.

Lesson 12. Demonstration. Gelatin Aspic, Whipped Cream, and Meringue

Supplies

Granulated gelatin
Bouillon cubes
1 can Jellied chicken or beef consommé
Ice cubes
½ pt. Whipping cream
Confectioners' sugar
Vanilla
1 Egg

Class Supplies

Staple supplies plus:
- Oranges for juice
- Table oranges
- Lemons
- Grapefruit
- Bananas
- Table apples
- Milk
- Whipping cream
- Eggs
- Cracked ice

Equipment

Utility tray
1 Measuring cup
1 Set measuring spoons
1 Cup strainer
3 Gelatin molds
1 Small tin pan
1 Bowl for cream
1 Larger bowl for ice
1 Bowl for meringue
1 Egg beater
1 Small saucepan
1 Cover for saucepan
1 Tablespoon

Unit V. Foods High in Minerals and Vitamins

Lesson 12. Combination of Fruits With Other Foods

Gelatins, Custards

I. Discussion

A. Gelatin (collagen)

1. Source—extracted from connective tissue, cartilage, or bones of animals by boiling and refining.
2. Physical properties—softens and swells in cold water, dissolves in hot water or other hot liquid, decomposes by boiling, sets into a jelly upon cooling.
3. Nutritive value—an incomplete protein because it lacks essential amino acids but is a valuable adjunct to the diet. It dissolves at body temperature.

B. Preparation of gelatin

1. Soak gelatin in cold water until softened; add hot liquid and stir till dissolved, or add gelatin to cold liquid and place in double boiler till dissolved.
2. Add sugar and stir till dissolved.
3. Add remaining liquids and mix thoroughly.
4. Strain through a fine wire strainer.
5. Pour into cold wet molds.
6. Surround molds with ice to congeal quickly, or put into a cold place for a longer time.

II. Demonstration

A. **Gelatin Aspic** (3 servings)

1. Made with bouillon cubes.

2 tsp. granulated gelatin	1 bouillon cube
¼ c. cold water	¾ c. boiling water

Prepare according to directions under **I, B.**

2. Made from canned consommé.

Note: Gelatin aspic may be used as an appetizer garnished with lemon and parsley, or it may be used as a base for molded meat, fish, or vegetable salads.

B. **Whipped Cream**

½ pt. whipping cream
1 tbs. confectioners' sugar
3 drops vanilla.

Set bowl in ice water and with cold egg beater whip cream until it barely holds its shape. Fold in sugar and vanilla. If beaten too long, it may turn to butter.

C. Meringue

1 egg white
1 tsp. lemon juice or few drops vanilla
2 tbs. confectioners' sugar

Beat white until stiff, add sugar gradually and continue beating until the mixture is fine grained and will hold its shape. Add flavoring. Meringue may be used uncooked as a garnish for desserts. To cook, drop from a tablespoon into simmering water, cover and cook for 5 minutes. Desserts and pies may also be topped with meringue and returned to a moderate oven (350° F.) until a delicate brown.

III. Class Work

A. Review soft custard (Lesson 6)

1. To cold custard, add diced oranges, bananas, peaches, or seedless grapes, and garnish with whipped cream or meringue. If meringue is used, make custard with 1 egg and 1 egg yolk, reserving 1 egg white for meringue.

B. Prepare gelatin desserts

1. **Lemon Gelatin** (1 pint or 4 servings)

1 tbsp. gelatin
½ c. cold water
¼ c. lemon juice
1 c. boiling water
⅓ c. sugar

Follow standard directions under **I, B.**

2. **Orange Bavarian Cream** (or **Orange Charlotte)**

2 tsp. gelatin
¼ c. cold water
½ c. boiling water
¼ c. sugar
½ c. orange juice
1 tbs. lemon juice
¼ c. whipped cream
(or 1 egg white, stiffly beaten)

Make gelatin according to standard directions. Set bowl in ice. When mixture begins to congeal, fold in whipped cream or egg white.

3. **Fruit Gelatin**

To recipe for lemon or orange or other fruit gelatin, add ½ cup diced fruit, either fresh, canned, or dried as soon as the gelatin begins to congeal.

Note: Raw pineapple contains an enzyme which prevents congealing.

4. **Spanish Cream** (3 servings)

1 tsp. granulated gelatin	1 egg
1 c. milk	1 tbs. sugar
¼ tsp. vanilla	speck of salt

Scald milk with gelatin in double boiler, add sugar, pour slowly on yolk of egg, slightly beaten. Return to double boiler and cook until thickened, stirring constantly. Remove from range, add salt, flavoring, and white of egg, beaten stiff. Turn into individual molds, dipped in cold water, and chill. Serve with cream, plain or whipped.

IV. Serving and judging of products.

Review Questions

Is gelatin a protein of high or low biological value?

To soften gelatin would you use hot or cold water? To dissolve it?

Lesson 13. Demonstration. Preparation of Lettuce or Other Salad Greens

Supplies

1 head Iceberg lettuce
1 head Garden lettuce
Curly endive
Watercress
Escarole
Parsley
Spinach
French dressing
Various crackers
Various cheeses

Equipment

Utility tray
Large bowl or pan
Vegetable knife
Long sharp knife
Cheese cloth bag or hydrator
Wooden salad bowl
Wooden salad fork and spoon
Cracker and cheese tray
Cheese knife

Class Supplies

Staple supplies plus ingredients needed for the salads assigned.

Unit V. Foods High in Minerals and Vitamins, Cont'd

Lesson 13. Salads

I. Discussion

Salads

1. A salad may be made of fruits, vegetables, meat, fish, cheese, or eggs served with salad greens and a suitable dressing.
2. The greens themselves may be served with a dressing as a salad.
3. The greens should be fresh, crisp, and clean, and the other ingredients of good shape and form. Wash greens carefully, and place in cheesecloth bag on ice, or in hydrator of electric refrigerator. Chill other ingredients.
4. Salad should be skillfully combined as to taste and color, and assembled immediately before serving. If ingredients are to be combined, mix lightly with a fork.

II. Demonstration

A. Preparation of lettuce or other salad greens.

1. Iceberg lettuce

   Remove any wilted leaves. With a small sharp knife cut out core and allow cold water to run down through the head. Leaves may then be separated, dried in a cheesecloth bag, and chilled.

2. Garden lettuce

   Remove wilted leaves, cut off root, and drop leaves into cold water. Proceed as for iceberg lettuce.

3. Other greens used for salads are endive, watercress, escarole, parsley, tender spinach, dandelion leaves, and shredded cabbage.

B. Arrangement of lettuce on plate.

Arrange lettuce leaves in cup form on plate, to hold and garnish the salad attractively.

C. Salad bowl or tossed greens.

D. Cracker and cheese tray.

III. Class Work (as assigned from below)

A. Fruit Salads

1. Canned fruits
   - a. Pear with cheese, olive, cherry, date, ginger.
   - b. Pineapple with cheese, olive, cherry.
   - c. Apricot with cheese, nuts, or coconut.
   - d. Figs with cheese.
2. Dried fruits
   - a. Prunes with cheese or peanut butter.
   - b. Dates with cheese and nuts.
3. Fresh fruits
   - a. Citrus fruits sliced or sectioned singly or in combination.
   - b. Citrus fruits with banana and pineapple and melon.
   - c. Citrus fruits with avocados.

B. Vegetable Salads
   1. Canned (or cooked fresh or frosted)
      a. Asparagus tips with egg or pimiento.
      b. Beans, green or waxed, with olives, onion, or chives.
      c. Beans, Lima, with green onion and radish.
      d. Cauliflower with grated cheese.
      e. Beet with egg or celery.
      f. Mixed canned vegetables with celery and peppers.
      g. Potato or macaroni.
   2. Fresh
      a. Stuffed celery.
      b. Cabbage.
      c. Raw cauliflower with orange.
      d. Cucumber.
      e. Tomatoes—plain or stuffed.
      f. Tossed greens—lettuce, chicory, endive, watercress, escarole, parsley, spinach, dandelions.

C. Review of sandwiches suitable to serve with fruit or vegetable salads.

IV. Serving and judging of salads as to appearance, palatability, and nutritive value.

Review Questions

What purposes may salads serve in menu planning?
What values do they have nutritionally?
What are the essentials of a well-prepared salad?

Lesson 14. Salads, Cont'd

Class Supplies

Staple supplies plus:
- Meat, chicken, or fish (for salad)
- Eggs
- Cottage cheese
- Cream cheese
- Celery
- Cucumber
- Onion
- Canned tomatoes
- Lemons or vinegar
- Light cream
- Olives or pickles
- Green peppers or Pimientos
- Nuts
- Lettuce
- Cooked salad dressing
- Mayonnaise
- Bouillon cubes

Unit V. Foods High in Minerals and Vitamins, Cont'd

Lesson 14. Salads, Cont'd

I. Class Work

A. Protein Salads

1. **Meat, Chicken, or Fish Salad** (2 servings)

⅔ c. cold cooked meat, chicken, or fish
⅓ c. diced celery or cucumber
¼ c. mayonnaise or cooked salad dressing

Remove all bone, skin, fat, or gristle from meat or fish. Cut into small cubes or flake (fish). Season with salt to taste. Toss meat and celery lightly with dressing. Arrange on bed of lettuce and serve at once.

2. **Egg Salad** (2 servings)

2 hard-cooked eggs, sliced
or 2 deviled eggs (see recipe)
lettuce
mayonnaise

Arrange sliced or deviled eggs on bed of lettuce and serve with mayonnaise. Eggs may be garnished with slices of cucumber, tomato, onion, or olives.

Deviled Eggs

Cut 2 hard-cooked eggs in halves lengthwise. Remove yolks, mash, season with ⅛ teaspoonful mustard, salt, and cayenne pepper to taste. Moisten with a little mayonnaise and pile lightly into whites. Sprinkle with a little paprika.

3. **Cottage Cheese Salad** (2 servings)

1 c. cottage cheese
*salt and pepper
light cream
lettuce leaves
¼ c. French dressing

Season cheese to taste and add light cream until of desired consistency. Serve on lettuce with French dressing.

*Additional flavor may be given by adding 1 tbs. chopped onion, chives, stuffed olives, or pimiento.

4. **Cream Cheese Balls**

1 pkg. (3 oz.) cream cheese
light cream
¼ c. any desired seasoning, such as chopped olives, pickles, nuts, green peppers, or pimientos

Soften cheese with cream and add seasoning. Shape into small balls. Arrange three balls on crisp greens and serve with French dressing. Cheese balls may also be used as a garnish for fruit or vegetable salads.

B. Molded Salads

Molded salads may be made with a gelatin base to which may be added fruit, vegetables, meat, fish, eggs, or cheese. They are served on lettuce and garnished with mayonnaise.

1. **Tomato Gelatin Salad** (2 servings)

2 tsp. gelatin	¼ tsp. salt
¼ c. cold water	¼ tsp. sugar

¾ c. hot strained tomato

Follow standard directions.

For a more highly seasoned aspic, the following may be used:

2. **Tomato Gelatin Salad** (2 servings)

2 tsp. gelatin	2 whole cloves
¼ c. cold water	¼ tsp. salt
1 c. canned tomatoes	speck of pepper
3 tbs. chopped celery leaves	speck of sugar
1 tbs. chopped celery	1 tsp. lemon juice
1 small slice onion	1 tsp. vinegar

Cook tomatoes, celery and celery leaves, onion, cloves, salt, pepper, and sugar for 10 minutes. Rub through a sieve and add lemon juice and vinegar. Pour over softened gelatin. Turn into molds and chill.

Tomato gelatin may be served with lettuce or other salad greens, and dressed with mayonnaise. Finely cut vegetables may be added as the mixture begins to congeal, or it may be molded in layers with cottage cheese.

2. **Jellied Meat, Fish, or Vegetable Salads** (2 servings)

2 tsp. gelatin	1 bouillon cube
¼ c. cold water	¾ c. boiling water
2 tbs. lemon juice	1 c. diced cooked meat, fish, diced cheese, or finely cut vegetables, either raw or cooked

Follow standard directions. Add meat, fish, cheese, or vegetables as mixture begins to congeal.

C. Review of muffins or popovers as an accompaniment to these salads.

D. Serving and judging of products as to appearance, palatability, and nutritive value.

Review Questions

Compare the use in the menu and the nutritional value of the salads in this lesson with those listed in the previous lesson.

Lesson 15. Demonstration. Syrups and Extracts

Supplies

½ c. Cocoa
½ c. Granulated sugar
½ c. Lactose
1½ c. Coffee

Class Supplies

Staple supplies plus:
- Lemons
- Oranges for juice
- Eggs
- Milk
- Apples
- Dates
- Raisins
- Steamed rice
- Whipping cream
- Light cream
- Cracked ice
- Ice cream salt
- Prepared syrups
- Food for exhibit

Equipment

Utility tray
2 measuring cups
4 Saucepans
3 Cooking spoons
1 Bowl strainer
Cheesecloth, 9 inch square
4 Jars for syrups

Unit VI. Water and Cellulose

Lesson 15. Foods With High Water and Cellulose Content

Bran Muffins, Fruit and Milk Drinks, Sherbets, Desserts

I. Exhibit of foods with different water and cellulose contents:

A. Milk and 5% vegetables.

B. Dried fruits and fresh fruits.

C. Refined cereals and whole grain cereals.

II. Demonstration

A. Syrups and Extracts

1. **Cocoa Syrup**

½ c. cocoa
½ c. sugar
1 c. water

Boil together slowly for 5 minutes without stirring, or cook in double boiler for ½ hour.

2. **Lactose Syrup**

½ c. lactose
1½ c. water

Bring to *boiling point* but do not boil.

3. **Coffee Extract**

a. ½ c. coffee
1 c. water

Bring to a boil, strain through cheesecloth.

b. 1½ c. sugar
1 c. coffee
2 c. water

Boil for 8 minutes and strain through cheesecloth.

III. Class Work

A. Fruit Drinks

1. **Lemonade** (1 serving)

¾ c. water
2 tbs. sugar
2 tbs. lemon juice

Boil water and sugar together for 1 minute. Cool and add fruit juice. Serve with crushed ice.

2. **Orangeade** (1 serving)

½ c. water
1 tbs. sugar
¼ c. orange juice
2 tbs. lemon juice

Make and serve like lemonade.

3. **Egg Lemonade** (1 serving)

1 egg
½ c. water
2 tbs. lemon juice
2 tbs. sugar

Beat egg well. Add other ingredients and blend. Serve chilled.

B. Cold Milk Drinks (1 serving) are made by adding various flavors to cold sweetened milk as follows:

	Milk	*20% Cream*	*Sugar*	*Flavor*
1.	¾ c.	¼ c.	1 tbs.	¼ tsp. vanilla
2.	¾ c.	¼ c.	1 tbs.	5 drops Mapleine
3.	¾ c.	--	--	¼ c. cocoa syrup
4.	⅝ c.	¼ c.	1 tbs.	⅛ c. coffee extract
5.	⅝ c.	¼ c.	--	⅛ c. fruit syrup

Chill ingredients, blend and beat thoroughly with egg beater or shake in milk shaker till frothy.

C. Eggnogs (1 serving)

1 egg
¾ c. milk
speck of salt
1 tsp. sugar
¼ tsp. vanilla or
1 tbs. sherry wine
speck of nutmeg

Chill ingredients and blend in shaker or with egg beater. Flavoring may be varied as with milk shakes.

D. Hot Milk Drinks

1. **Chocolate** (1 serving)

½ oz. (1½ tbs.) chocolate
2 tsp. sugar
speck of salt
¼ c. hot water
¾ c. milk
3 drops vanilla

Melt chocolate over low heat, add sugar, salt, and hot water. Boil for 2 minutes. Add to the milk which has been heated in the double boiler. Add vanilla and beat with egg beater till frothy. Serve plain, with whipped cream or with a marshmallow.

2. **Malted Milk** (plain or chocolate, 1 serving)

2 tbs. malted milk powder
speck of salt
¾ c. hot water or milk

Moisten the milk powder gradually with enough of the liquid to form a smooth paste. Then add remaining hot water (or milk). Serve plain or with cream added. For cold malted milk, add powder to cold milk and beat thoroughly with egg beater.

E. Bran Muffins (1 dozen)

Temperature 425° F.
Time 20 to 30 minutes

1 c. sifted flour
1 c. bran
3½ tsp. baking powder
½ tsp. salt
3 tbs. brown sugar
1 egg, well beaten
⅔ c. milk
3 tbs. shortening, melted

Add bran to sifted dry ingredients. Combine egg, milk, and shortening, and add to flour mixture, stirring only until mixed.

Add ½ cup chopped raisins or prunes or ¼ cup each if desired.

F. **Cereal Puddings**

1. **Apple Tapioca** (2 servings)

Baking temperature 375° F. — Time approx. 30 minutes

1 tbs. Minute tapioca
¾ c. water
3 tbs. sugar
1 c. sliced apples

Cook tapioca and water in double boiler until transparent. Add one-half the sugar. Arrange the apples in a buttered baking dish, sprinkle with the remaining sugar, and pour the tapioca over them. Bake until apples are tender.

2. **Raisin Rice Pudding** (2 servings)

Temperature 350° F. — Time 25 to 30 minutes

1½ tbs. rice
1 c. milk
¼ tsp. salt
1 egg
2 tbs. sugar
¼ c. raisins (scalded)

Steam rice in milk till tender. Beat egg slightly, add sugar, salt, cooked rice, and raisins. Pour into a baking dish, set in hot water, and bake until set.

3. **Caramel Date Pudding** (2 servings)

1 c. milk
¼ c. dates
speck of salt
1⅓ tbs. cornstarch
¼ c. sugar
¼ tsp. vanilla

Scald the milk in a double boiler, leaving out enough cold milk to mix with cornstarch and salt. Caramelize the sugar in a frying pan, and pour the syrup slowly into the hot milk. When dissolved, add cornstarch mixture and stir constantly until thick. Add vanilla and chopped washed dates. Pour into wet molds. Chill and serve with cream.

IV. Discussion

A. Judging of products.

B. Nutritional contributions of foods prepared.

Review Questions

For what reasons would you serve citrus fruit drinks to a patient? When would milk drinks be preferable?

What is cellulose? What purpose does it serve in the dietary?

Lesson 16. An Adequate Diet

Class Supplies

Staple supplies plus:
- Grapefruit
- Juice oranges
- Table oranges
  or fresh tomatoes
- Flours
  - Corn meal
  - Bran
  - Whole wheat
- Eggs
- Milk
- Butter
- Parsley (sprigs and
  chopped)
- Bread
- Cold diced chicken or
  canned tuna fish
- Chicken stock
- Potatoes (for baking)
- Lemons
- Lettuce
- Corn (cream style)
- Fish fillets
- Canned tomatoes
- Fresh or frosted spinach
- Onions
- Carrots
- Sliced ham for baking
- Whole cloves
- Bay leaves
- Light cream
- Cracked ice
- French dressing

Unit VII. Meal Planning and Preparation

Lesson 16. An Adequate Diet at Medium or Low Cost Table Service

I. Breakfast

A. Menus

1. Grapefruit Halves
Foamy Omelet Corn Meal Muffins
Coffee

2. Orange Juice
Shirred Eggs Bran Muffins
Coffee

3. Sliced Orange
Scrambled Eggs Whole Wheat Muffins
Coffee

4. Orange Halves
Goldenrod Eggs Popovers
Coffee

B. A selection may be made as to the menu to be served for breakfast, or the several breakfasts may be assigned according to the size of the class. All food preparation is review, and recipes are found in previous lessons.

II. Luncheon or Supper

A. Menu

Baked Chicken Timbales With Béchamel Sauce
Baked Potatoes
Sliced Orange or Tomato Salad
French Dressing
Hot or Iced Tea
Spanish Cream

B. Recipes

Chicken Timbales (4 servings)

Temperature 400° F.	Time approx. ¾ hour
1 tbs. butter	¼ c. dry bread cubes
⅔ c. milk	1 c. chopped cooked chicken
1 tbs. chopped parsley	2 eggs
speck of salt	speck of pepper

Melt butter, add bread cubes and milk, and cook for 2 minutes, stirring constantly. Remove from fire, add chicken, parsley, and eggs, slightly beaten. Season with salt and pepper. Turn into individual molds filling them two-thirds full. Set molds in pan of hot water, cover with waxed paper, and bake until set.

2. **Béchamel Sauce** (1 cup).

½ c. chicken stock	1 tbs. butter
1 slice onion	1 tbs. flour
1 slice carrot	½ c. milk
bit of bay leaf	¼ tsp. salt

sprig of parsley

Cook stock with onion, carrot, bay leaf, and parsley for 10 minutes and strain. Melt butter, add flour, and gradually stock and milk. Season with salt and pepper. Bring to boiling point as for white sauce. Place over hot water until ready to serve.

3. **Baked Potatoes.**

Temperature 450° F. Time ¾ to 1 hour.

Thoroughly scrub potatoes of uniform size. Dry and cover with fat. Bake.

4. **Orange or Tomato Salad.**

Arrange slices of orange or tomato on lettuce leaves and dress with French dressing.

5. **Tea.**

Strain freshly made hot tea (over ice) and serve with slice of lemon.

6. **Spanish Cream.**

Directions given in Lesson 12.

III. Dinner

A. Menu

Cream of Corn Soup
Baked Slice of Ham or
Baked Fillets of Fish with Tomato Sauce
Mashed Potato, Spinach or Broccoli
Caramel Date Pudding
Coffee

B. Recipes

1. **Cream of Corn Soup.**

Make according to directions in Lesson 9.

2. **Baked Slice of Ham** (4 servings).

Temperature 375° F. Time approx. 1 hour.

1 lb. slice of ham (1 inch thick)	1 c. water
6 whole cloves	1 c. light brown sugar
	watercress or parsley

Simmer the ham in water to cover for 15 minutes and drain. Stick cloves into the fat of the ham. Sprinkle the sugar over the ham, add the water, and bake until tender, basting occasionally. Serve on a hot plate, garnished with watercress or parsley.

3. **Baked Fish with Tomato Sauce** (4 servings).

Temperature 375° F. Time approx. 30 minutes.

1 lb. fresh fish fillets	3 tbs. butter
2 c. canned tomatoes	3 tbs. flour
1 c. water	1 tsp. salt
1 slice of onion	$\frac{1}{8}$ tsp. pepper
4 cloves	2 tsp. sugar

Cook for 10 minutes the tomatoes, water, onion, cloves, and sugar. Melt the butter, add the flour, and stir into the hot mixture. Add the salt and pepper. Cook for 10 minutes and strain. Surround the fish in a baking pan with half the sauce, and bake until fish is cooked, basting frequently. Remove to a hot plate, pour on the remaining sauce, and serve.

4. **Mashed Potato** (4 servings).

4 medium-sized potatoes	$\frac{1}{4}$ tsp. salt
2 tbs. butter	speck of pepper
$\frac{1}{3}$ c. milk or cream	

Pare potatoes and boil in salted water until tender. Drain and shake over heat to dry. Force through a ricer or mash well with a fork or a wire masher. Add seasonings, butter, and hot milk, and beat until light. Add more milk if too dry. Taste and serve at once, or keep over hot water until ready to serve. Pile lightly on serving dish or plate. Dot with butter and sprinkle with paprika if desired.

5. **Spinach or Broccoli.**
   Prepare and cook according to directions in Lesson 10.
6. **Caramel Date Pudding.**
   Make according to directions in Lesson 15.
7. Review boiled, drip, or percolated coffee.

IV. Discussion

A. Appearance, palatability, cost, and nutritional adequacy of the day's dietary.

B. Table service—proper setting and serving.

"Then to lay the table. . . . I do like to sit at a table properly laid, for I think the sight of knives and forks in their places, with glasses and the good furniture of eating, gives something more to the appetite, for your fingers have an itch to be using them. And nothing more I hate than a table laid without care. Stains on a cloth, or wrinkles, or a knife not in the straight, a fork turned aside, a spoon put the wrong way up, will have my thoughts in a knot until they are put right . . . and laying a cloth so that too much is not on one side or too little on the other becomes an exercise in patience almost to a waste of time, though worth the trouble when done."

—From Richard Llewellyn: "*How Green Was My Valley*," New York, 1940, The Macmillan Company.

Table Service

I. General considerations

Considerable latitude to meet individual ideas may be allowed in setting the table, provided always that perfect balance is attained as to spacing and proportion. In other words, whatever plan is used it should be carried out with precision with the end result of a beautiful composition in mind.

The linen should be immaculately clean and beautifully ironed; the silver should be brightly polished; the glassware should sparkle, and the china, free from cracks or chips, should shine.

Fig. 89.—A smartly dressed table. Stately elegance and festive dining is the keynote of this gleaming crystal and silver table. (Courtesy of Carole Stupell, New York City.)

II. The table cover

A. Tablecloth

1. Should be underlined with a silence cloth (except in the case of a lace cloth).
2. The center crease, with cloth right side up, should extend in a *straight* line from the head to the foot of the table, with the opposite edges hanging a uniform distance from its edge (8 to 10 inches).

B. Place mats (for less formal meals)

1. The silence cloth is omitted.
2. Place mats should be spaced evenly, and the weave should run parallel to the edge of the table.

III. Centerpieces (flowers, fruit, or ornaments)

1. Should be placed in the exact center, flanked (at dinner) with four candlesticks placed equidistant from it.
2. If two centerpieces are used, place them at equal distances from the center with the candles between (as in Fig. 89).
3. At the small table a low centerpiece is preferable in order not to obstruct the view or the conversation. For a large table, taller decorations may be used, because conversation is carried on at either side rather than across the table.
4. The height of the candles should be in proportion to the holders and to the table. At informal meals they may carry out the color scheme, but for formal dinners white is preferred.

IV. The covers

A. Consist of the silver, glasses, dishes, and napkins to be used by one person.

1. Allow from 20 to 24 inches in length and from 15 to 16 inches in depth for each cover in order not to crowd the guests.

B. The silver (handles in a straight line 1 inch from the edge of the table).

1. Place in the order to be used, beginning at the outside and using toward the plate.
   a. Forks, to the left (except the oyster fork), tines upward (not more than three).
   b. Knives to the right (not more than two); spoons and oyster fork to the right.

C. The glasses (goblets or tumblers)

1. Place at tip of the knife and slightly to the right of it.
2. If wine is served, not more than three glasses are used, claret, wine, and champagne, placed in a diagonal line from the goblet and to the right.

D. The bread and butter plate

1. Place at the tip of the fork and to the left of it.

   NOTE: Bread and butter are not served at formal dinners.

E. The napkin

1. If the first course is on the table, place napkin to the left of the fork with selvage and open corners to the right.
2. Otherwise place in a three-lap fold on the service plate.

F. The service, place, or cover plate

1. Used at formal dinners with maid service in order that at no time shall a place remain uncovered.

G. Place cards (plain white for large dinners)
   1. Place above the place plate or on top of the napkin.
   2. For small dinners the hostess designates the places as the guests enter and cards are not used.

V. Other dishes
   A. Pepper and salt shakers
      Place a pair for each two persons.
   B. Two or more pairs of pottery, glass, or silver dishes are put at the corners between the candlesticks and the centerpiece, or wherever there are equally spaced vacancies, for salted nuts, mints, fruit, or fancy cakes.
   C. For formal meals nothing to eat is set on the table except the small dishes noted above. All food is passed by the butler, his assistants, or maids.
   D. For informal meals, with little or no maid service, food is served at the table by the host and hostess and guests as follows:
      Hostess: soup, salad, dessert, and beverage.
      Host: meat.
      Guests (or other members of the family): vegetables and gravy.

VI. Service rules
   A. Order of service
      1. The woman guest of honor at the host's right is served first, and so on, in order around the table to the left, or in reverse order at alternating courses.
      2. The hostess is served last.
   B. Directions for service
      1. All clean plates and all dishes of food are presented from the left.
      2. All soiled plates are removed from the left.
      3. All beverages and right-hand implements are placed and removed to the right.
      4. Dishes are never stacked at the table.

Review Questions

Why are timbales set in hot water while baking?

Béchamel sauce and tomato sauce are variations of what sauce previously made?

Spanish cream is a variation of what desserts previously made?

What satisfactions may derive from a well-set table?

Lesson 17. An Adequate Diet, Cont'd

Class Supplies

Staple supplies plus:

- Lemons
- Juice oranges
- Table oranges
- Grapefruit
- Whole grain cereal
- Eggs
- Milk
- Light cream
- Store cheese
- Butter
- Cornflakes
- Crackers (for crumbs)
- Cabbage
- Green peppers
- Tomatoes (canned)
- Raw carrots
- Onions
- Lettuce
- Meat stock
- Bacon
- Ground beef
- Potatoes
- Cooked rice
- Vegetables for salad
- Apples or rhubarb
- Whole wheat flour

Unit VII. Meal Planning and Preparation, Cont'd

Lesson 17. An Adequate Diet at Medium or Low Cost, Cont'd

Table Manners

I. Menus

A. Breakfast

Fruit in season
Whole Grain Cereal
Egg or Bacon   Muffins or Toast (enriched)
Marmalade or Jam
Coffee
Cream   Sugar

All preparation for breakfast is review, and recipes are found in previous lessons.

Fig. 90.—A tempting breakfast tray. (Courtesy of Dr. Jerome H. Leadley, Rochester, N. Y.)

B. Luncheon

Tomato Soup
Baked Rice with Cheese
Vegetable Salad   Whole Wheat Muffins or Bread
Banana Custard
Milk or Tea

1. **Tomato Soup** (4 servings)

1 c. canned tomatoes
2 tbs. butter
1 slice onion
2 tbs. flour
2 c. water or stock
½ tsp. salt
speck of pepper

a. Heat and strain tomatoes, obtaining 1 cup purée.
b. Melt butter, add onion, and brown slightly. Add flour and gradually pour on boiling water or stock.
c. Blend *a* and *b*, bring to boiling point, season with salt and pepper. Strain and hold over hot water until ready to serve.

2. **Baked Rice with Cheese** (4 servings)

Temperature 350° F. Baking time 15 to 20 minutes.

2 c. cooked rice	½ tsp. salt
1 c. American cheese	4 tbs. butter
1 c. milk	4 tbs. cracker crumbs

Add grated cheese to hot rice. Season with salt, add milk. Pour into buttered baking dishes, cover with crumbs, dot with butter, and bake.

3. **Vegetable Salad**

Select vegetables in season. Almost any cold cooked or raw vegetables on hand may be used, taking care that flavors and colors blend harmoniously. Marinate with French dressing, and serve any favorite mayonnaise or cooked dressing in addition if desired.

4. **Banana Custard** (4 servings)

1 large banana	1 c. cold soft custard

Arrange slices of banana in serving dishes. Pour over the custard and top with meringue. Make custard according to directions in Lesson 6, using yolks of 2 eggs and white of 1, saving 1 egg white for meringue.

5. **Meringue**

Prepare according to directions in Lesson 12.

C. Dinner

Meat Loaf

Mashed Potato	Creamed Carrots
Tossed Greens	Bread and Butter
Apple or Rhubarb Dessert	Coffee (cream and sugar)

1. **Meat Loaf** (4 servings)

Temperature 350° F. Time 1 hour.

1 lb. of round of beef ground with	1 egg, beaten
2 oz. salt pork	2 tbs. cream
few drops lemon juice	1 tsp. salt
¼ small onion minced	speck of pepper
⅛ green pepper minced	2 tbs. cracker crumbs

Mix ingredients in order given. Bake in loaf tin or casserole; or shape into a roll, wrap in waxed paper, place on a rack in dripping pan and bake, basting every 10 minutes with 2 tablespoons butter melted in ½ cup hot water.

DETAILS OF THE NORMAL ADULT DIET (LESSON 17)

(This is also the typical plan for the hospital "house" diet)

		GRAMS				MILLIGRAMS			VITAMINS					
									A	B1	B2	C	D	NIACIN
	AMOUNT	P.	F.	C.	CAL.	CA.	P.	FE.	(I.U.)	MICROGRAMS		MG.	I.U.	MG.
BREAKFAST														
Fruit average (1 orange)	1	1	0	11	48	33	23	0.40	190	80	30	50	–	0.2
Whole grain cereal (oatmeal)	¾ c.	3	2	17	98	15	105	2.00	–	143	195	–	–	–
Egg and/or	1	7	6	0	82	54	210	2.70	1,140	120	340	–	25	0.1
Bacon† cooked 10 gm.	1 slice	1	5	0	49	1	11	0.08	–	42	10	–	–	0.2
Toast, enriched white	1 slice	3	0	13	64	14	25	0.50	–	60	38	–	–	0.6
Butter, 5 gm.	1 pat	0	4	0	36	1	1	0.01	165	–	–	–	–	–
Marmalade or jam	2 tbs.	0	0	24	96	–	–	–	–	–	–	–	–	–
Coffee, clear	1 c.	–	–	–	–	–	–	–	–	–	–	–	–	–
Cream, 20%	4 oz.	4	24	2	240	116	92	0.08	996	36	168	–	16	0.2
Sugar	2 tsp.	0	0	10	40	–	–	–	–	–	–	–	–	–
LUNCHEON OR SUPPER														
Tomato soup‡	6 oz.	1	6	5	78	8	19	0.40	772	43	25	8	–	0.5
Baked rice and cheese‡	½ c.	12	24	29	378	343	143	0.20	1,091	36	248	–	–	0.1
Vegetable salad	½ c.	2	0	11	52	32	52	1.30	6,270	90	60	7	–	0.7
French dressing	1 tbs.	0	10	0	–	–	–	–	–	–	–	–	–	–
Whole wheat bread	1 slice	3	1	14	77	17	105	0.70	0	80	43	–	–	1.0
Butter, 5 gm.	1 pat	0	4	0	36	1	1	0.01	165	–	–	–	–	–
Banana	¼	0	0	6	24	2	7	0.15	108	23	15	3	–	0.15
Soft custard	¼ c.	5	5	8	98	77	108	0.70	380	52	165	–	–	0.06
Meringue	¼ egg white	1	0	0	4	1	1	–	–	–	16	–	–	0.06
	1 tsp. sugar	0	0	5	20	–	–	–	–	–	–	–	–	–
Milk 200 c.c.	1 glass	8	8	10	144	236	186	0.14	320	80	340	2	–	0.10
DINNER														
Meat loaf	1 slice	11	13	1	178	16	139	1.80	176	88	127	–	3	2.70
Mashed potato	½ c.	3	7	21	160	43	87	0.70	317	163	40	17	–	1.23
Creamed carrots														
Carrots	½ c.	1	0	9	40	39	37	0.8	12,000	70	60	6		0.50
Medium white sauce	¼ c.	3	8	6	108	63	63	0.2	347	43	117	–	–	0.21
Green salad (cabbage)	1 c.	0	0	2	8	18	12	0.3	30	28	24	20	–	0.10
French dressing	1 tbs.	0	10	0	–	–	–	–	–	–	–	–	–	–
Apple or rhubarb crisp (average)	½ c.	0	6	41	218	49	39	0.9	405	64	35	16	–	0.25
Lemon sauce	¼ c.	0	6	23	146	3	3	0.15	247	5	–	6	–	0.03
Coffee with 20% cream	2 oz.	2	12	1	120	58	46	0.04	498	18	84	–	8	0.10
Sugar	2 tsp.	0	0	10	40	–	–	–	–	–	–	–	–	–
Totals		71	161	279	2682	1240	1515	14.26	25,617	1364	2180	135	52	9.09

Normal standards (Sedentary man or moderately active woman).

10 to 15% total calories at 2,682 cal.—67 to 100 gm. protein.
25 to 45% total calories at 2,682 cal.—75 to 123 gm. fat.
40 to 50% total calories at 2,682 cal.—268 to 335 gm. carbohydrate.
Vitamin A 5,000 I.U. units.
Thiamine 1,200 micrograms (1.2 mg.)
Riboflavin 1,600 micrograms (1.6 mg.)
Ascorbic acid 70 to 75 mg.
Vitamin D adult level not set.
Niacin 12 mg.

Recommended daily allowances for specific nutrients, Committee on Foods and Nutrition, National Research Council.

†In cooking bacon, the fat loss is variable. Crisp bacon has approximately ½ the fat content of raw.

‡Value for a cooked or mixed food will vary according to recipe used. Values in this table are based on recipes in Lesson 17.

2. **Mashed Potato**

Prepare according to directions in Lesson 16.

3. **Creamed Carrots** (4 servings)

2 c. thinly sliced carrots — 1 c. medium white sauce

Wash, scrape, and thinly slice young carrots. Cook until tender in boiling salted water (according to directions in Lesson 10). Drain and combine with white sauce. Hold over hot water until ready to serve.

4. **Tossed Greens**

Prepare according to directions as demonstrated in Lesson 13.

5. **Apple or Rhubarb Crisp** (4 servings)

Temperature 375° F. Time 45 minutes.

2 c. sliced apples or 1 inch pieces rhubarb	1 c. cornflakes
	¼ c. sugar
	2 tbs. butter

Put one-half the fruit in a buttered baking dish. Sprinkle with sugar and one-half the cornflakes. Dot with butter. Repeat. Bake at 375° F. for 45 minutes. Serve with sugar and thin cream or lemon sauce.

6. **Lemon Sauce** (1¼ cups)

½ c. sugar	1 c. boiling water
1 tbs. corn starch	1 tsp. grated lemon rind
¼ tsp. salt	2 tbs. lemon juice

2 tbs. butter

Mix together sugar, cornstarch and salt; gradually stir in hot water, bring to a boil and cook 15 minutes, or until thick and clear. Stir in lemon juice, rind, and butter.

II. Discussion

A. Table manners

B. Appearance, palatability, nutritional adequacy,* and cost of meals served.

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*For nutritional adequacy of this day's menu, see accompanying table.

Table Manners

I. General considerations

A well-poised manner and consideration of the rights of others constitute good manners at table just as in other social phases of life.

II. Promptness at meals

Be informed as to the time of a meal and never be late.

III. Care in appearance

Show the hostess the courtesy of always appearing at your best whether in dinner dress or uniform.

IV. Rules of precedence (formal meals)

1. Host leads the way to the dining room with the guest of honor. Hostess enters last with her escort, but is seated first.
2. At the close of the meal, the hostess leads the way from the dining room to the drawing room, where coffee may be served if it was not served at table.

V. Position at table

At ease but never slouched.

VI. Use of implements

1. Silver
   a. Use from outside in.
   b. Spoons
      (1) Fill soup or bouillon spoon away from you.
      (2) Eat from side of spoon, quietly.
   c. Forks—uses
      (1) Fish and meat
      (2) Vegetables (except liquid ones)
      (3) Salads
      (4) Some desserts
         (a) Dessert spoon for others
   d. Knives—uses
      (1) Manner of cutting
         Elbows at the side, not akimbo.
   e. Placing of silver after use—parallel across center of plate.
   f. Playing with utensils is bad manners.
2. Napkin
   a. Lay folded in half or thirds across the lap. Use as inconspicuously as possible.
   b. At close of meal, place at left side of cover, folded if a house guest, otherwise unfolded.
3. Cups—in holding cup, fingers should assume a natural position.
4. Finger bowls. Two forms of service:
   a. Single
      Finger bowl on a doily is set on the dessert plate with the dessert fork and spoon on either side. Guest removes bowl and doily and places above plate. Dessert is passed.

b. Double

Dessert with necessary implements is placed for each guest. Finger bowls on a separate plate are placed when the dessert is removed.

VII. Manner of eating

1. Quietly with lips closed.
2. Take some (even if only a small amount) of each dish offered in order not to offend hostess.
3. Eat all on plate but do not scrape it.
4. Always break bread to butter it and place it on bread and butter plate.

   (Bread and butter are not served at formal dinners.)

VIII. Serving—depends upon formality of the meal

A. Express preferences promptly if asked, otherwise make no comment.

B. Help to serve others only if maid service is not used.

C. Never reach in front of another.

IX. Accidents

A. As little attention as possible is paid to accidents by the hostess or her guests.

X. Conversation

A. Show deference to those older.

B. Introduce only pleasant topics.

C. Avoid disagreeable topics or those likely to conjure unpleasant pictures.

D. Do not monopolize conversation but contribute a share.

Review Questions

Discuss the cost of the menus presented in Lesson 17 with those in Lesson 16.

Why is it important to know and to observe good table manners?

Lesson 18. Adaptation of the Family Menu to Children

Class Supplies

Staple supplies plus:
- Prunes or apricots
- Canned orange juice
- Canned tomato juice
- Farina
- Whole wheat bread
- White bread
- Milk
- Evaporated milk
- Canned lima beans
- Canned peas
- Cabbage
- Carrots
- Dates
- Eggs
- Sausage
- Potatoes
- Rutabaga
- Apples for baking

Unit VII. Meal Planning and Preparation, Cont'd

Lesson 18. Adaptation of the Family Menu to Children at Low Cost

I. Menus

A. Breakfast

Adults	*Children*
Canned orange juice or stewed prunes	Orange juice or prune juice
Farina with milk and brown sugar	Farina with milk and brown sugar
Whole wheat toast	Whole wheat toast
Butter	Butter
Coffee with cream or evaporated milk	Milk

Fig. 91.—A satisfying luncheon tray. (Courtesy of Dr. Jerome H. Leadley, Rochester, N. Y.)

B. Luncheon or Supper

Lima bean soup	Lima bean soup
Croutons	Croutons
Raw vegetable sandwich	Raw vegetable sandwich
Peanut butter sandwich	Peanut butter sandwich
Tapioca cream	Tapioca cream
Tea or milk	Milk

C. Dinner

Tomato juice	Tomato juice
Sausage	Poached egg

Baked or mashed potato	Mashed or baked potato
Mashed rutabaga	Rutabaga or buttered peas
Baked apples or stewed fruit	Baked apple or fruit pulp
Milk, tea, or coffee	Milk

II. Recipes—those not given here are found in previous lessons

A. Raw Vegetable Sandwich

Use raw vegetables in season, as ground cabbage, carrot; or lettuce, tomato; and make according to directions in Lesson 10.

B. Peanut Butter Sandwich

½ c. peanut butter	¼ c. milk

Mix peanut butter with milk until it is smooth and light in color Spread on white or whole wheat bread or combine a slice of each.

C. Tapioca Cream (3 servings)

1 c. hot milk	1 egg
1½ tbs. Minute tapioca	1½ tbs. sugar
speck of salt	¼ tsp. vanilla

Cook tapioca and salt for 15 minutes in milk in double boiler, stirring frequently. Beat egg yolk well. Add sugar. At end of 15 minutes stir egg and sugar slowly into milk and tapioca. Cook until it thickens like custard. Remove from fire and stir in white of egg, beaten stiff. Add flavoring, pour into molds and chill.

D. Fried or Baked Sausage

Pierce each sausage several times with a fork. Put into frying pan, cover with boiling water, and cook for 15 minutes. Drain, return to pan, and fry until well browned, or put on broiler and bake in oven according to directions for bacon in Lesson 8.

E. Baked Apples

Wash and core apples. Put in baking dish and fill cavities with sugar, allowing 1 tablespoon sugar and a speck of cinnamon or nutmeg to each apple. Cover bottom of dish with boiling water, and bake at 400° F. until soft, basting often with syrup in dish. Serve hot or cold with or without cream.

NOTE: For adults apples may be stuffed with raisins or mince meat before baking.

III. Discussion

Adaptation of the family meals to children, and the appearance, palatability, and nutritional adequacy of the meals served.

Review Questions

What advantages are there in serving one menu for all the family?

Lesson 19. An Adequate Diet at High Cost

Class Supplies

Staple supplies plus:

- Lemons
- Juice oranges
- Table oranges
- Grapefruit
- Dry cereal
- Fresh eggs
- Bacon
- Sweetbreads (parboiled)
- Tenderloin steaks
- Chicken stock
- Bread
- Butter
- Milk
- Light cream
- Whipping cream
- Saltines
- Small crackers
- Fresh mushrooms
- Potatoes (for baking)
- Frosted asparagus
- Frosted peas
- Onions
- Tomato juice
- Water cress and parsley (sprigs and chopped)
- Cabbage
- Stuffed olives
- Salad oil
- Vinegar
- Worcestershire sauce
- Crushed pineapple
- Marmalade
- Cream cheese
- Chopped nuts
- Mint or
- Cherries (for garnish)
- Cracked ice

Unit VII. Meal Planning and Preparation, Cont'd

Lesson 19. An Adequate Diet at High Cost

Review of Table or Tray Service

I. Menus

A. Breakfast

Orange Juice
Prepared Cereal with Cream
Egg as desired — Bacon
Toast — Butter — Marmalade
Coffee

Prepare according to directions previously given.

B. Dinner

Cream of Fresh Mushroom Soup — Toasted Crackers
Tenderloin Steak — Parsley Garnish
Stuffed Baked Potato — Fresh (or Frosted) Peas
Dressed Cole Slaw with Sliced Olives
Fruit Gelatin — Whipped Cream
Demitasse

C. Luncheon or Supper

Hot Tomato Juice with Whipped Cream,
Minced Parsley or Chives — Saltines
Creamed Sweetbreads — Toast Points
Fresh (or Frosted) Asparagus Tips
Grapefruit Salad with Cheese Balls and Cress (or salad in season)
Pineapple Bavarian Cream
Tea with Lemon

II. Recipes—Those not given are found in previous lessons.

A. **Cream of Mushroom Soup** (4 servings)

¼ lb. fresh mushrooms
2 tbs. butter
¼ tsp. salt
1 slice onion

1 c. cream
1 c. milk
speck of pepper
paprika

Cook onion gently in butter to straw color. Remove onion and add mushroom caps, peeled and cut into small pieces. Sauté until tender, and add them to the milk and cream which have been heated in a double boiler. Season to taste, and serve very hot.

B. **Stuffed Baked Potato**

Cut off top of baked potato lengthwise and scoop out inside. Mash and season with salt, pepper, 2 teaspoons butter, and 1 tablespoon cream. Pile lightly in skin and return to oven to brown slightly.

C. Dressed Cole Slaw

Shred cabbage paper thin with a large knife. Spread lightly on salad plate, garnish with sliced stuffed olives, and dress with French dressing.

D. Grapefruit Salad

Lay three fresh grapefruit sections on a bed of cress. At the side place two cream cheese balls rolled in chopped nuts. Dress with fruit French dressing.

E. Fruit French Dressing (1 pint)

½ c. powdered sugar	1 tsp. Worcestershire sauce
2 tsp. paprika	¼ c. lemon juice
½ tsp. salt	¼ c. orange juice
¼ tsp. mustard	¼ c. white vinegar
speck of pepper	1⅓ c. salad oil

Blend as French dressing in Lesson 5.

F. Pineapple Bavarian Cream (2 servings)

1 tsp. granulated gelatin	yolk of 1 egg
2 tbs. cold water	½ c. whipped cream
½ c. crushed pineapple	

(Use 2 tablespoonfuls sugar when making with fresh pineapple.)

Soak gelatin in cold water. Heat crushed pineapple, and pour into beaten egg yolk. Cook until mixture thickens slightly. Remove from fire, add soaked gelatin, and stir until dissolved.* Let stand in a cool place until it begins to set. Fold in whipped cream. Garnish with cherry.

III. Preparation of menus; tray or table setting as assigned.

IV. Discussion

A. Appearance, palatability, and nutritive value of menus served.

Review Questions

Compare cost of these menus with those given in Lesson 17. Are they nutritionally more adequate?

*Add sugar to taste if necessary.

Unit VIII. Examination

Lesson 20. Preparation of Dinner

Each instructor will have her own ideas for a practical examination in cookery. The serving of a dinner, however, with the students working in pairs in its preparation seems to afford equal opportunity for all to demonstrate the progress made during the course. This gives opportunity also for a final checking of proper serving and correct table or tray service.

The menus which follow are suggestive, but may be varied in accordance with the season of year, the food supplies available, and the capacity of the students. All items are review of recipes and techniques used during the course. Students should be assigned their work at the previous class in order to bring with them the necessary recipes. Work should be done independently, without communication with other students or with the instructor.

Dinner Menus

Cream of Celery Soup
Broiled Chicken
Parsley Potatoes   Frosted Asparagus
Broiled Pineapple with Currant Jelly
Grapefruit Salad   Fruit French Dressing
Floating Island
Coffee

Tomato Juice Cocktail
Broiled Lamb Chops
Creamed Potatoes   Buttered Carrots
Celery   Radishes
Lemon Gelatin   Custard Sauce
Coffee

Apricot Cocktail
Liver and Bacon
Mashed Squash   Silver Skin Onions
Fresh Fruit or Vegetable Salad
Junket
Coffee

Fresh Fruit Cup
Veal Fricassee with Vegetables
Mashed Potatoes
Head Lettuce   Olive French Dressing
Baked Rice Custard
Coffee

AN OUTLINE FOR TEACHING NUTRITION IN SPECIAL CONDITIONS

Unit I. The Normal Pregnancy (3 to 4 hours)

A. Review of adult normal nutrition
   1. Requirements for energy, protein, minerals, and vitamins.
   2. Foods (including amounts) that will supply these requirements.

B. Nutrition in the antenatal period
   1. Changes in requirements.
   2. Foods which should be emphasized or increased.
   3. The prevalence of inadequate nutrition, and its effect on the health of the mother and infant.
   4. Food fallacies related to pregnancy.
   5. The use of concentrates of minerals and vitamins in the prenatal period.

C. Dry diet for use in vomiting of pregnancy.

D. Diet during labor
   1. Emphasis on carbohydrate foods which will leave the stomach quickly and are easily digested.
   2. Emphasis on fluids.

E. Nutrition in the postnatal period
   1. The need for increased calories, proteins, minerals, and vitamins if the mother is nursing her baby.
   2. Return to normal nutrition with possibly an increased energy requirement even if the mother is not nursing the baby.
   3. Foods which will supply these needs.

Suggested Problems:
   1. Diets to be made out for normal pregnancy.
   2. Diets which may be used during labor.
   3. Observation and teaching of mothers' nutrition classes.
   4. Studies of food intakes in normal pregnancy.
   5. List low cost sources of minerals and vitamins.

Unit II. Complications of Pregnancy in Which Diet Is a Factor (1 to 2 hours)

A. Anemias of pregnancy
   1. Foods rich in iron.
   2. Importance of vitamins as well as iron, since a deficiency of iron-bearing foods may result in a vitamin deficiency also.

B. Cardiac disease in pregnancy
   1. Salt and fluid restriction.
   2. Distending foods.

C. Toxemia of pregnancy
   1. Normal functions of liver and kidney.
   2. Salt and protein regulation.
      a. Need for retention of complete proteins.

b. Foods and quantity permitted
   (1) Low protein diets.
   (2) High protein diets.

D. Diabetes
   1. Need for an adequate diet as in normal pregnancies.

E. Tears and lacerations during delivery
   1. Low residue diet: foods omitted and allowed.

Suggested Problem:

1. Diets to be made out for anemias of pregnancy; variations in protein for toxemia; low residue diets.

Unit III. Infancy and Childhood (5 to 10 hours)

Nutrition of infants (birth to 2 years): Anatomy and physiology of infant digestive tract compared with adult; significance of prenatal and infant nutrition in relation to later health; tendency for early feeding attitudes and habits to persist; infant's quantitative and qualitative nutritional needs, allowing for individual differences; basis for judging optimal nutrition in infants.

Nutrition needs of early infancy: Advantages of breast feeding to child, mother, and society; composition of breast milk and character of curd; comparison with cow's milk; conditioning factors in mother's supply of milk; contraindications for breast feedings; wet nursing; expression and care of breast milk; accessory foods; breast milk stations.

Artificial feedings: Meaning of certified, pasteurized, Grade A and Grade B milk; evaluation of commercially prepared milks, calculation of simple formulas; schedules of feedings; advantages of gradual weaning; factors determining age of weaning, such as degree of development; three meals a day schedule.

Therapeutic milk modifications and other foods: Skimmed milk, buttermilk, whey, peptonized milk, junket, protein milk, acidified milk, acidophilus milk; soybean meal and thick cereals, banana and other feedings used in diarrhea, dysentery, celiac disease, pyloric spasm, and rumination.

Development of good habits of eating: Physiological and psychological factors; provision for gradual development of skills and their attendant satisfactions; amount of self-help to expect from young child; eating equipment of young child; relation of good food habits to nutrition; the importance of the first year of life in the establishment of good habits; methods of gaining child's cooperation in accepting foods.

Special nutritional requirements of pre-school, school, pre-adolescent, and adolescent age: Factors of sex, body-build, activity and growth; psychological factors, including racial likes and dislikes; economic factors; kind of protein best suited to child's needs; best sources of vitamins and minerals; water requirement; cost of foods in relation to family budget; the part played by good food and health habits in good nutrition of children.

Therapeutic diets for children: modification of the normal diet for malnutrition, obesity, acute and chronic infections, disease and disturbances of the gastrointestinal tract, diabetes, kidney diseases, rheumatic fever, epilepsy, deficiency diseases, allergies, disorders of dentition.

Unit IV. Old Age (1 to 2 hours)

A. The need for an adequate diet under conditions of lessened activity.
   1. Decreased caloric intake.
   2. Decreased protein intake.
   3. Otherwise the diet of convalescence or childhood.
      a. Easily digested foods.
      b. Bulk neither excessive nor too rough.

B. The modification of diet in conditions which may arise in old age.

AN OUTLINE FOR TEACHING DIET THERAPY

(Order to be correlated with medical and surgical lectures)

Fifteen 1-Hour Periods

Lecture	Demonstration Tray
I. Introduction	
A. Objectives of the course. B. Review of food nutrients and their functions.	Typical hospital house diet (to be used as a standard for therapeutic adjustments).
C. Review of metabolism. 1. Energy. 2. Basal.	See text p. 532 (or use menu of house diet for that day).
II. Introduction, Cont'd	
A. Discussion of food values of house diet. 1. Have students decide upon the following: a. Protein, fat and carbohydrate values. b. Uniform servings. c. Weights of bread, butter, milk, sugar and cream.	
B. Discussion of other routine hospital diets. 1. Adjustment of pattern diet to soft and liquid diet.	Hospital house diet adjusted as soft diet.
III. Diet Modifications in Conditions of the Respiratory System	
A. Fevers. 1. Food metabolism. 2. Feeding in general. B. Fevers of long duration. 1. Tuberculosis. 2. Typhoid. C. Fevers of short duration. 1. Pneumonia.	Hospital house diet adjusted as liquid or soft diet and enriched for added calories.

IV. Diet Modifications in Conditions of the Gastrointestinal System	
A. Sippy diet. B. Smooth diet. C. Constipation. 1. Atonic. 2. Spastic. 3. Obstructive. D. Postoperative. Gastric regime (S.M.H.)	Hospital house diet adjusted as smooth diet. (See text p. 438, column 4) or select tray from postoperative regime of local hospital.
V. Diet Modifications in Conditions of the Gastrointestinal System, Cont'd	
A. Diarrhea. B. Liver and gall bladder disturbances. C. Celiac disease. D. Steatorrhea. E. Low fat diets.	Hospital house diet adjusted to low fat, high carbohydrate, and protein. (See text p. 438, column 8.)
VI. Diet Modifications in Allergy and in Conditions of the Skin	
A. Allergic disturbances. B. Food allergies. C. Elimination diets and Rowe diets.	
Diet Modifications in Conditions of the Musculo-Skeletal System A. Arthritis. B. Gout.	Hospital house diet adjusted to low purine. (See text p. 438, column 3.)
VII. Diet Modification in Conditions of the Endocrine Glands and Metabolism	
A. Diabetes. 1. History of development of diabetic diets. 2. Determination of a diabetic prescription. 3. Calculation of a diabetic prescription. 4. Adjustment to a soft or liquid diet; to the lunch box or restaurant meal.	Hospital house diet adjusted as a diabetic diet. (See text p. 438, column 6.) (Students to adjust to a given prescription.)

B. Insulin. 1. Insulin shock. 2. Diabetic coma. a. Diet treatment.	
VIII. Diet Modification in Conditions of the Endocrine Glands and Metabolism, Cont'd	
A. Addison's Disease. B. Hyperthyroidism. C. Hyperinsulinism.	Hospital house diet adjusted as high caloric diet. (See text p. 440, column 3.)
IX. Diet Modifications in Conditions of the Endocrine Glands and Metabolism, Cont'd	
A. Overweight. 1. Low calorie diets. B. Underweight. 1. High calorie diets.	Hospital house diet adjusted as a low calorie diet. (See text p. 440, column 2.)
X. Diet Modification in Conditions of the Circulatory System; Blood and Blood-Forming Organs	
A. Anemia. 1. Liver therapy. 2. Iron therapy. B. Cardiac conditions. C. Hypertension.	Hospital house diet adjusted for anemia. (See text p. 438, column 7.)
XI. Diet Modifications in Conditions of the Urinary and Genitourinary Systems	
A. Nephritis. B. Nephrosis. C. Uremia. D. Protein adjustments—high, moderate, low. E. Salt—amounts and limitations.	Display protein foods for comparison of protein equivalents with respect to amounts of food, or hospital house diet adjusted for high and/or low protein. (See text p. 440, columns 4 and 5.)
XII. Diet Modifications in Conditions of the Nervous System	
A. Acidotic conditions related to fat-carbohydrate ratio. 1. Preoperative. 2. Postoperative. 3. Pernicious vomiting.	Hospital house diet adjusted to high fat, low water, low carbohydrate. (See text p. 440, column 7.)

B. The ketogenic diet and calculation of the FA:G ratio.
   1. Uses of the diet.

C. Water balance and water in foods.
   1. Dry diets.

XIII. Diet Modifications for Deficiency Conditions

A. Mineral deficiencies.
   1. Calcium.
   2. Phosphorus.
   3. Iodine.

Hospital house diet adjusted to high calcium, high vitamin. (See text p. 440, column 6.)

XIV. Diet Modifications for Deficiency Conditions, Cont'd

A. Vitamin deficiencies.
   1. B complex, C.

Hospital house diet with additional foods to show diet high in vitamins B complex and C respectively.

XV. Diet Modifications for Deficiency Conditions, Cont'd

A. Vitamin deficiencies.
   1. A, D, E, K.
   2. Other postulated vitamins.

Hospital house diet with additional foods to show diet high in vitamins A, D, E, and K, respectively.

XVI. Examination

Modern type:
- True-false.
- Completion.
- Single choice.
- Multiple choice.
- Matching.
- Essay.

PART V

QUESTIONS FOR GENERAL REVIEW

1. What is meant by the term metabolism?
2. Under what conditions is basal metabolism measured? Why?
3. Show by calculation your approximate caloric requirements.
4. What factors would influence this value?
5. What is the purpose of digestion?
6. What are the end products of protein digestion?
7. What value would there be in having an analysis of the stool?
8. What role does the circulation of blood play in nutrition?
9. What is meant by the term anemia?
10. Does any relationship exist between the mind and food utlization?
11. What influence do the endocrines exert on one's state of nutrition?
12. Name four endocrines.
13. How are foods classified?
14. What is meant by the biological value of a protein?
15. Can proteins "supplement" one another? How?
16. Of what value is liver?
17. What directions should be given for its cooking? Why?
18. How much protein should the normal adult diet contain?
19. How many grams should a "high protein" diet contain?
20. Name four conditions under which a high protein diet is advantageous.
21. How do light and dark fish differ in composition?
22. What is the nutritive value of milk?
23. How do cheese and milk compare in composition?
24. What is meant by pasteurization of milk?
25. How should milk be handled in the home?
26. What is the nutritive difference between butter and margarine?
27. How does cooking alter starch?
28. How may fruits and vegetables be classified?
29. Do fruits and vegetables differ in nutritive value? Explain.
30. What are the symptoms of vitamin A deficiency?
31. What is the "recommended allowance" for ascorbic acid for the normal individual?
32. Is this the same as the "minimum requirement"? Give reason for your answer.
33. What is your approximate requirement for thiamine?
34. How might this be met?
35. What is the role of iron in the body?
36. What is the calcium requirement for a 1-year-old child?
37. Is fluid intake important in health? Give reason for your answer.

38. How accurately do tables of food composition indicate the nutritive value of foods?
39. What factors influence the nutritive value of vegetables?
40. Do you consider a food diary of value? Why?
41. List the basic seven food groups and indicate the composition and value of each group.
42. Are proteins and carbohydrates incompatible in the diet? Give reason for your answer.
43. Of what value are nuts in the diet?
44. Outline a daily diet pattern for yourself.
45. How would you alter this to bring about weight loss?
46. What are the disadvantages of obesity?
47. When is a person considered obese?
48. How could you approximately determine your normal weight without reference to a height-weight table?
49. How rapidly should weight be lost? Why?
50. Suggest a means of increasing your diet by 1,000 calories daily.
51. Could a vegetarian diet be adequate? Explain.
52. What adjustments should be made in the diet during pregnancy? Why?
53. Would the diet for pregnancy be adequate for lactation?
54. How would you calculate the formula for a baby weighing 8 pounds?
55. Outline a diet which might be served to a 9-month-old baby.
56. How does the diet of a 2-year-old child differ from that of an adult?
57. Can dental caries be influenced by diet? Give reason for your answer.
58. How would the diet for a man 85 years of age differ from the diet of one 35?
59. What factors should be considered in planning the diet for an older person?
60. How could the normal diet be converted into a smooth diet?
61. What is meant by a bland diet?
62. Differentiate between a liquid, semisolid and convalescent diet.
63. Upon what principle is the diet for the diabetic based?
64. How would the written prescription in terms of grams of P F and C differ for the diabetic and the normal individual, if both had a need for 3,000 calories daily?
65. Would the type of insulin used alter the diet pattern? How?
66. What are the characteristics of the diet in celiac disease? Why should the bananas used on the diet be fully ripe?
67. How may hyperinsulinism be treated?
68. What restriction is usually made for gout?
69. What organ dysfunction causes Addison's disease?
70. What types of disorders occur along the gastrointestinal tract?
71. How could these affect the food intake?
72. What specific instructions should be given a gastric ulcer patient?
73. What is the diet currently used for liver disorders?
74. Is a low or high protein diet indicated in albuminuria? Give reason.
75. What are renal calculi?

76. What is meant by the "rice diet"?
77. What are the outstanding features of the low sodium diet?
78. Why is this type of diet sometimes used?
79. How does this differ from the low "salt" diet?
80. What foods should be emphasized in anemia?
81. What effect does fever have on the need for food?
82. What is meant by a ketogenic diet? How could a diet be altered to bring this about?
83. What foods commonly cause allergy?
84. What are elimination diets?
85. What precautions must be taken in planning the diet for allergy?
86. Name three skin disorders which result from food deficiencies?
87. What are the characteristics of pellagra?
88. Is this condition curable? Give reason for your answer.
89. What is meant by a subclinical deficiency?
90. How may they be detected?
91. Name three factors that might alter food needs?
92. Are data on the cholesterol content of foods ever of value? Give reason for your answer.
93. What factors other than food and physical defects influence health?
94. How would you explain an apparent food deficiency in a person consuming an apparently adequate diet?
95. Do you consider nutrition a "pure science"? Give reason for your answer.
96. What precautions must be taken in the cooking of protein food?
97. Suggest a menu which might be tray served to a woman 60 years old who is not acutely ill and has no need for an adjusted diet.
98. Outline a diet for a man who had a colostomy a month past.
99. What general directions should be followed in preparing a tray?
100. What knowledge has been gained in this course, which can be practically applied to your own life?

PART VI

REFERENCES

Abbreviations for Journals Cited

Agricultural Experiment Station Bulletins	Agric. Exper. Sta. Bull.
American Journal of Digestive Diseases	Am. J. Digest. Dis.
American Journal of Diseases of Children	Am. J. Dis. Child.
American Journal of the Medical Sciences	Am. J. M. Sc.
American Journal of Physiology	Am. J. Physiol.
American Journal of Public Health	Am. J. Pub. Health
Annals of Allergy	Ann. Allergy
Annals of Internal Medicine	Ann. Int. Med.
Archives of Internal Medicine	Arch. Int. Med.
Archives of Pediatrics	Arch. Pediat.
Journal of the American Dietetic Association	J. Am. Dietet. A.
Journal of the American Medical Association	J. A. M. A.
Journal of Biological Chemistry	J. Biol. Chem.
Journal of Clinical Investigation	J. Clin. Investigation
Journal of Dairy Science	J. Dairy Sci.
Journal of Experimental Education	J. Exper. Educ.
Journal of Experimental Medicine	J. Exper. Med.
Journal of Nutrition	J. Nutrition
Journal of Pediatrics	J. Pediat.
Medical Clinics of North America	M. Clin. North America
New England Journal of Medicine	New England J. Med.
Nutrition Reviews	Nutr. Rev.
Physiological Reviews	Physiol. Rev.
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PART VII
APPENDIX

TABLE 102.—*Approximate* FOOD VALUES FOR GROSS PLANNING OF DIETS

Since the *100-calorie* portion is, in general, the average serving, or a simple fraction or multiple thereof, it is possible to list, **roughly**, foods of equal caloric content in typical food groups. Within these groups the foods suggested are interchangeable, and one selects the food preferred. Such a list follows:

Cereals (100 cal.)
20 gm. C., 4 gm. P., 1 gm. F.
- Corn flakes, 1¼ cups
- Cream of Wheat, ⅔ cup
- Grape Nuts, 3 tbs.
- Muffets or shredded wheat, 1
- Oatmeal, cooked, ¾ cup
- Puffed wheat or rice, 1 cup

Fruits (100 cal.)
20 gm. C., 2 gm. P.
- Apples, 1 large
- Apricots, dried, 8 halves
- Banana, 1 small
- Canned cherries, ⅔ cup
- Grapefruit, ½, 1 cup juice
- Grapes, 1 med. bunch
- Orange, 1 large, 1 cup juice
- Pear, 3 halves
- Peaches, 3 halves
- Pineapple, 1 slice
- Prunes, 3 to 4
- Watermelon, large serving

Breads and Crackers (100 cal.)
Breads 20 gm. C., 3 gm. P., 1 gm. F.
Crackers 16 gm. C., 3 gm. P., 3 gm. F.
- White or brown, 1 thick slice
- Parker house roll, 1
- Saltines, 6
- Oyster crackers, 36
- Melba toast, 2 slices
- Zwieback, 3 slices

Potato or Potato Substitute (100 cal.)
20 gm. C., 3 gm. P.
- White potato, 1 med.
- Potato chips, ⅔ cup
- Sweet potato, ½ med.
- Macaroni, cooked, 1 cup
- Noodles, cooked, ¾ cup

Vegetables (100 cal.)
20 gm. C., 2 gm. P.
- Baked beans, ⅓ cup
- Lima beans, ½ cup
- Kidney beans, ½ cup
- Peas, ¾ cup
- Corn, ⅓ cup

Desserts—Variable

Puddings (Spanish cream)	12 gm. P., 7 gm. F., 21 gm. C.
Cakes (butter)	4 gm. P., 8 gm. F., 26 gm. C.
Pie (apple)	3 gm. P., 7 gm. F., 30 gm. C.

(100 cal.)
- Ginger snaps, vanilla wafers, chocolate wafers, 5
- Macaroons, 2 or 3
- Fruits (see above)
- Sugar cookies, 1

(200 cal.)
- Pie, small piece
- Puddings, average serving
- Fried cakes, 1
- Cake, average piece
- Ice cream, average serving

Vegetables (25 cal.)
5 or less gm. C., 1 gm. P.
- Asparagus, 6 stalks
- Cabbage, cooked, ⅔ cup
- Cauliflower, large serving
- Greens, ½ cup
- Mushrooms, 6
- Sauerkraut, ½ cup
- Spinach, ½ cup
- Tomato, fresh, 1 med.
- Tomato, canned, ½ cup
- Tomato juice, ½ cup
- Turnips, ½ cup

Vegetables (50 cal.)
10 gm. C., 1 gm. P.
- Beets, diced, ½ cup
- Carrots, ½ cup
- Onions, 2 med.
- Turnips, ½ cup

Vegetables (75 cal.)
15 gm. C., 1 gm. P.
- Lima beans, fresh, ½ cup
- Corn on cob, 2 small ears
- Parsnips, ½ cup
- Peas, young, ½ cup

Meats, med. fat (150 cal.)
16 gm. P., 10 gm. F.
- Porterhouse, sirloin, rump, average serving
- Pork loin, 1 med. chop
- Veal cutlet, large serving
- Ham, small serving
- Leg of lamb, small serving
- Broiler, large serving
- Fowl, small serving

Meat Substitutes (100 cal.)

American cheese	6 gm. P., 8 gm. F.
Cottage cheese	18 gm. P., 1 gm. F., 4 gm. C.
Egg	9 gm. P., 7 gm. F.

- Liver, average serving
- Sausage, frankfurt, 1
- Cottage cheese, 5 to 6 tbs.

TABLE 102—CONT'D

Cheese, 1¼ in. cube
Oysters, ⅔ cup
Scallops, ¼ cup
Bacon, 2 to 3 slices
Sausage, pork, 1 small
Fish, average serving (except salmon, mackerel, whitefish, roe, small serving of these)
Egg, 1 to 1½

Beverages (100 cal.)

Whole milk 5 gm. P., 6 gm. F., 7.4 gm. C.
Skim milk 9 gm. P., 1 gm. F., 14 gm. C.
Fruit juice 23 gm. C., 1 gm. P.

Milk, ⅔ cup
Skim milk, 1⅛ cups
Buttermilk, 1⅛ cups
Carbonated drinks, 1⅓ cups
Fruit juice, 1 cup

Miscellaneous (100 cal.)

Butter, 1 tbs.
Sugar, 5 tsp.
Cream (coffee), 4 tbs.
Mayonnaise, 1 tbs.
Jelly, 1½ tbs.
Cream (whipping), 2 tbs.

Candies (100 cal.)

Variable—largely sugars
Caramels, 1
Nougats, 1½
Chocolate peppermints, 1½
Gum drops, 3
Marshmallows, 4
Fudge, 1 in. cube
Milk chocolate, ⅓ of 5 cent bar

Table 103.—Food Equivalents for Interchanges in the Diet

Foods when nearly equal in food value, may be substituted for one another in the diet. Fruits, vegetables, and cereals are interchanged on the basis of their carbohydrate content; butter, cream, and oils according to their fat content; and meats, cheese, and eggs according to the amounts of protein and fat which they contain.

Five per cent vegetables are those which contain approximately 5 gm. carbohydrate per 100 gm. vegetable (1 level teaspoonful of sugar weighs 5 gm.). In general, a serving of vegetable will weigh approximately 100 gm. and can be measured roughly as a half cup.

A 10% vegetable or fresh fruit, or fruit canned without sugar, contains 10 gm. carbohydrate per 100 gm. Obviously, there is as much carbohydrate in a half cup of a 10% vegetable as in 1 cup of a 5% vegetable.

An attempt to classify foods into a few groups sufficiently inclusive to be practical, of course, has disadvantages. More sharply defined grouping according to carbohydrate content, by increasing the number of groups, makes for cumbersome detail. For example, the 5% group is sometimes further divided into 1, 3 and 5% vegetables; the 10%, into 6, 9 and 12% vegetables, etc. If one takes into account the differences in composition, age, freshness, cooking losses, etc., perhaps this wide grouping should still be used until new data accumulate. When more complete analyses are available, reclassification can be undertaken.

A classification of vegetables follows:

5% and under (may be averaged as 3%)

Artichokes, French
Asparagus
Beet greens
Broccoli
Brussels sprouts
Cabbage
Cauliflower
Celery
Cucumber
Eggplant
Endive
Kohlrabi
Leeks
Lettuce
Mushrooms
Peppers, green or red
Radish
Sauerkraut
Swiss chard
Spinach
Squash, summer
String beans, very young or canned*
Tomatoes and tomato juice
Water cress

10%

Beets
Carrots
Celery roots
Onions
Peas, very young or canned*
Pumpkin
Rutabagas
Squash, winter or Hubbard
String beans, fresh
Turnip

15%

Artichokes, Jerusalem
Beans, Lima, very young or canned*
Corn, on cob and young
Parsnips
Peas, fresh
Salsify or vegetable oyster

20%

Beans, baked
kidney
Lima
navy
shelled butter
Corn, canned
Lentils
Succotash, canned
Potato, white

Rice, Macaroni, Hominy — may be considered to have same value as 20% vegetable

The vegetables containing 10% or less carbohydrate have a protein content of approximately 1%; the 20% group contains, on the average, 3% protein.

Fruit values are based on products canned without additional sugar.

*Liquid discarded — heated in fresh water.

TABLE 103—CONT'D

The value for fruits is essentially the same whether the fruit is raw or canned, providing the canning is done without sugar. The canning may be as a water pack, or the fruit may be canned in its own juice (juice pack). However, water-packed fruits, if the water is discarded, have a somewhat reduced carbohydrate content (approximately 4%), compared with fresh fruit, due to carbohydrate that goes into solution.

The 5% fruits are: avocado, honeydew melon, watermelon, muskmelon, rhubarb, and strawberries.

The 10% fruits are:

Canned	*Fresh*
Applesauce	Blackberries
Apricots	Cranberries
Blackberries	Currants
Blueberries	Grapefruit
Cherries	Lemons
Figs	Loganberries
Fruit salad	Oranges
Grapes, seedless	Peaches
Grapefruit, also juice	Tangerines
Loganberries	
Peaches	
Pears	
Pineapple slices	
Plums	
Raspberries, red or black	

Fruits considered as approximately 15% are as follows:

Apples	Huckleberries
Apricots, fresh	Pears
Blueberries, fresh	Pineapple juice
Cherries, sour	Raspberries, fresh
Grapes	

Fruits considered as approximately 20% are:

Bananas	Grape juice
Cherries, sweet	Prunes and plums, fresh
Figs, fresh	

All dried fruits are over 60% carbohydrate.

At times it may not be convenient to measure fruits in terms of the cup, if so the following equivalents may be used:

1 small orange (No. 216) 100 gm. of a 10% fruit
½ large orange or ½ cup juice
1 medium peach, fresh, or 2 halves canned without sugar
1 small apple or ½ large
1 small pear or ½ large, canned
⅓ average banana or ½ small, 3 inches
3 halves dried apricots or 1½ fresh
¾ cup blackberries, ½ cup canned
½ cup blueberries or huckleberries, fresh
1 cup cranberries
½ cup fresh cherries or ⅓ cup canned—approx. 15 cherries
½ cup raspberries
1 cup strawberries, 10 to 15, depending upon size
⅔ cup gooseberries
2 cup rhubarb, unsweetened
2 dates
¾ fig
8 Malaga or Tokay grapes

15 Concord grapes
2 plums or prunes, dried or fresh
½ cup pineapple tidbits or 1 slice ½ inch thick if fresh
⅓ cup raisins
¼ large, ½ medium, or ⅔ cup grapefruit juice
1 cup watermelon or muskmelon cubes or ¼ med. cantaloupe
½ grapefruit
1 large tangerine
or the fruit may be replaced by
1 cup 5% vegetable
½ cup 10% vegetable
¼ cup 20% vegetable

Fat Interchanges

Substitutes for 1 tablespoonful butter (3 teaspoonfuls)
1 tablespoonful mayonnaise
1 tablespoonful salad oil
2 tablespooonfuls 40% cream
4 tablespoonfuls (¼ cup) 20% cream (coffee cream or top from unshaken quart of milk)

Cereal Interchanges

½ cup oatmeal
(all 15 gm. uncooked weight)
½ cup cooked Pettijohn's
⅓ cup cooked Wheatena, Cream of Wheat, Farina, corn meal, cream of rye
½ shredded wheat or muffet
½ cup corn flakes, Wheaties, rice flakes
¾ cup "puffed" cereals, popped corn
¾ piece "sliced" bread

Bread Interchanges

1 piece "sliced" bread (white, graham, whole wheat, rye)
2½ Uneeda biscuits
6 "animal" crackers
5 small graham crackers
½ potato-size medium lemon
⅓ cup 20% vegetable
⅓ cup macaroni or rice
½ matzoth biscuit
1¼ tablespoonfuls flour—unsifted

Egg or Meat Interchanges

1 egg or 1 ounce meat
1¼ inch cube of American cheese
1½ inch cube of cream cheese (2 tablespoonfuls)
3 tablespoonfuls cottage cheese + ½ tablespoonful butter
1 frankfurt sausage
1 ounce lean meat or 1 egg
2 teaspoonfuls peanut butter
4 sardines 3 inches long
1 ounce salmon or tuna fish
1 ounce nonfatty fish plus 1 teaspoonful butter

Milk

Evaporated (unsweetened) milk may be substituted for whole milk by using ½ as much evaporated as whole milk. Powdered milk may be used by substituting 4 level tablespoonfuls powdered whole milk for 1 cup liquid whole milk (8 oz.).

Miscellaneous

Broth and bouillon, or Vegex, flavorings and diabetic gelatins may be used as extras.

TABLE 104

APPROXIMATE PROTEIN VALUES (See Table 125 for Details)

		GM.
Bacon	3 slices	2
Breads	1 slice "sliced"	3
Cereal	Average 1 oz. servings	
	Oatmeal	4½
	Puffed, flaked, etc.	2
	Whole wheat	3
Cheese	Average serving 1½ × 1 × 1 in. cube	
	American or Cream	8
	Cottage 2 tbs.	6
	Swiss 1 slice	11
Eggs	White	3
	Whole	6
	Yolk	3
Fish—Fowl—Meat	1 oz. serving	6
	Average serving 3-4 oz.	
Fruits	Average size of ½ c. cut up	1
Gelatin	Average serving—½ c.	2
Legumes	Average serving—½ c.	6-8
Meat	See Fish	
Milk	Fluid buttermilk Skim or whole	
	1 qt.	32
	1 c.	8
	Dried Malted 1 tbsp.	1
	Skim 1 tbsp.	3
	Whole 1 tbsp.	2
	Evaporated 1 tbsp.	1
Oysters	Average serving 5 or 6	6
Peanuts	30 nuts or 2 tbsp. butter	8
Potato	White 1 average (5 oz.)	3
Vegetables other than legumes or potato		
	Average serving—½ c.	1
A few special foods or puddings—1 tbsp. each		
	Betene	3
	Casec	2
	Casein (crude edible)	9
	Cocomalt	1½
	Dietene	2½
	Nutramigin	1¾
	Olac	2
	Protein Milk	3
	Soy Flour	6
	Vegex	3½
	Yeast—Dried	6

TABLE 105

APPROXIMATE CALORIE CONTENT OF COMMON FOODS*

Food	*Amount*	*Approximate Calories*
Apple, baked, with sugar	1 large	150
Apple, fresh	1 large	100
Applesauce, sweetened	1 average serving	140
Apricots, canned	1 average serving	100
Apricots, dried, stewed, sweetened	1 average serving	75
Apricots, fresh	1 large	25
Asparagus, canned	1 average serving	15
Asparagus, fresh	1 average serving	15
Avocado pear	⅓	165
Bacon	1 average serving	85
Banana	1	100
Beans, green, string	1 average serving	30
Beans, Lima, dried, stewed	1 average serving	175
Beans, Lima, fresh	1 average serving	125
Beans, navy, cooked	1 average serving	150
Beef, corned	1 average serving	125
Beef, dried, creamed	1 average serving	250
Beef, Hamburg	1 cake	125
Beef, meat loaf	1 average serving	150-200
Beef, pot roast (lean)	1 average serving	200
Beef, round (lean)	1 average serving	150-200
Beef, sirloin, roast (lean)	1 average serving	150
Beef-vegetable stew	1 average serving	250
Beet greens	1 average serving	30
Beets	1 average serving	40
Biscuit, baking-powder	1 medium	75
Blackberries, fresh	1 average serving	75
Blueberries, fresh	1 average serving	75
Bluefish	1 average serving	125
Bologna sausage	1 average serving	120
Bread, corn	1 slice	150-200
Bread, enriched, 100% whole-wheat, rye, etc.	1 slice	65-75
Bread, raisin	1 slice	85-100
Broccoli	1 average serving	30
Brussel sprouts	1 average serving	50
Butter	1 average pat	100
Buttermilk	1 glass	90
Cabbage, cooked	1 average serving	50
Cabbage, raw, shredded	1 average serving	20
Cake, angel-food	1 average serving	125-150
Cake, frosted	1 average serving	150-175
Cake, layer, frosted and filled	1 average serving	400-450
Cake, plain	1 average serving	100-125
Cake, sponge	1 average serving	125-150
Candy	1 piece	50-100
Cantalope	½	60
Carrots, cooked	1 average serving	50
Cauliflower	1 average serving	20

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Food	*Amount*	*Approximate Calories*
Celery	2 stalks	10
Cereal, cooked	1 average serving	100
Cereal, ready-to-serve	1 average serving	50-100
Chard, Swiss	1 average serving	45
Cheese, American, Gruyere, Swiss	1 average serving	100-125
Cheese, cottage	1 generous serving	85
Cheese, cream	1 small serving	80
Cherries, canned	1 average serving	100-150
Cherries, fresh	1 average serving	75
Chicken, roast	1 average serving	200
Clams, round	1 average serving	80-100
Cod steak	1 average serving	125
Collards	1 average serving	65
Cookies, plain	1	50
Corn, canned	1 average serving	150
Corn, fresh	1 average serving	150
Crab meat, canned	1 average serving	70
Crackers, butter or saltines	1	15
Cranberry sauce, canned	1 average serving	75
Cream, heavy	2 tablespoons	125
Cream, coffee	2 tablespoons	50
Cucumber	1 average serving	10
Custard, baked or "boiled"	1 average serving	125
Dandelion greens	1 average serving	40
Dates, pitted	1	20-25
Eggs	1	70-75
Escarole	1 average serving	25
Fish cakes	2	200-250
Frankfurter	1 medium	100
Gelatin, fruited	1 average serving	100-125
Gingerbread	1 average serving	200
Grapefruit	½ medium	100
Grapefruit juice	¾ cup	75
Grapefruit sections	1 average serving	65
Grapejuice	¾ cup	130
Grapes, Concord	1 medium bunch	80
Gravy, brown	1 tablespoon	20-25
Halibut	1 average serving	175
Ham, cooked	1 average serving	250-300
Hash, beef	1 average serving	350
Honey	1 average serving	50
Honeydew melon	2 tablespoons	200
Ice cream, commercial	1 average serving	200-250
Ice, fruit	1 average serving	150-175
Jams, jellies	1 average serving	100
Kale	1 average serving	40
Kidney	1 average serving	150
Lamb (lean)	1 average serving	150-200
Lamb stew	1 average serving	400
Lentils	1 average serving	150
Lettuce	1 average serving	20
Liver	1 average serving	200
Liverwurst sausage	1 average serving	100-150
Lobster meat	1 average serving	100
Loganberries	1 average serving	75
Macaroni	1 average serving	135

Food	*Amount*	*Approximate Calories*
Mackerel	1 average serving	125-150
Margarine	1 average pat	100
Milk, condensed, sweetened	1 tablespoon	65
Milk, evaporated	¼ cup	90
Milk, skimmed	1 glass	90
Milk, whole	1 glass	170
Muffins	1 medium	100-150
Mustard greens	1 average serving	30
Noodles	1 average serving	135
Oatmeal	1 average serving	90-100
Okra	1 average serving	30
Onions	1 medium	30-35
Orange juice	1 cup	130-140
Oranges, whole	1	80-100
Oysters	1 average serving	100-120
Parsnips	1 average serving	65
Peaches, canned	1 average serving	90-100
Peaches, fresh	1	50-60
Peanut butter	2 tablespoons	200-225
Pears, canned	1 average serving	50
Pears, fresh	1	50-60
Peas, canned, drained	1 average serving	65
Peas, fresh	1 average serving	85
Peppers, green	1 large	25
Persimmon	1	100
Pie, apple	1 average wedge	250
Pie, blueberry	1 average wedge	275
Pie, cherry	1 average wedge	375
Pie, custard	1 average wedge	250
Pie, lemon meringue	1 average wedge	350
Pie, mince	1 average wedge	350
Pie, pumpkin	1 average wedge	300
Pie, rhubarb	1 average wedge	275
Pineapple, canned	1 average serving	75
Pineapple, fresh	1 average serving	65
Pineapple juice, canned	1 glass	150
Plums, fresh	1	25-30
Pork, cooked	1 average serving	150-200
Potatoes, French fried	1 average serving	125
Potatoes, mashed	1 average serving	125
Potatoes, sweet	1	200-225
Potatoes, sweet, candied	1 average serving	300
Potatoes, white, baked, or boiled	1	100
Prunes, dried, stewed, sweetened	1 average serving	125
Pudding, bread	1 average serving	250-300
Pudding, cornstarch	1 average serving	200
Pudding, rice	1 average serving	125-150
Radishes	1 average serving	10-12
Raisins	1 tablespoon	40-45
Raspberries, fresh	1 average serving	65
Rhubarb, stewed, sweetened	1 average serving	125
Rice, brown or white	1 average serving	100-125
Rolls, Parker House	1	100
Rutabagas	1 average serving	75

Food	*Amount*	*Approximate Calories*
Salad dressing	1 average serving	
Boiled	1 average serving	50
French	1 average serving	150
Mayonnaise	1 average serving	150
Russian	1 average serving	125
Salmon, canned or fresh	1 average serving	100-150
Sandwich	1	250-300
Sardines, canned	1 average serving	75-100
Sausage, pork	1	60
Scallops, fried	1 average serving	250
Shad roe	1 average serving	200
Sherbet, fruit	1 average serving	175-200
Soda, bottled	1 average serving	65-75
Soda, ice-cream	1 average serving	300-350
Soup, bouillon or consommé	1 average serving	20
Soup, cream-of-vegetable	1 average serving	175-200
Soup, tomato, clear	1 average serving	75
Soup, vegetable	1 average serving	80-100
Soybeans, yellow, dried	1 tablespoon	50
Spinach	1 average serving	30
Squash, Hubbard	1 average serving	60
Squash, summer	1 average serving	30
Strawberries, fresh	1 average serving	60
Succotash	1 average serving	175
Sugar, brown	1 tablespoon	35
Sugar, granulated	1 teaspoon	17
Sundae	1	350-500
Tangarine	1	40-50
Tapioca cream	1 average serving	125
Tomato juice	½ cup	30
Tomatoes, canned	1 average serving	40
Tomatoes, fresh	1	30-40
Tongue	1 average serving	125
Tuna fish	1 average serving	150
Turkey	1 average serving	300
Turnip greens	1 average serving	45
Turnips, white	1 average serving	35
Veal, cooked	1 average serving	200
Water cress	1 average serving	5
Watermelon	1 average serving	100-125

Inasmuch as the calculation of the sodium value of the diet is practiced so frequently at the present time, the following detailed table is offered:

Sodium and Potassium Analyses of Foods and Waters From the Research Laboratory of Mead Johnson & Company, 1947

Foreword

Previously available tables giving the sodium content of foods and public water supplies have always been compiled from data obtained by the conventional methods of chemical analysis. It is well known that in most of these methods traces of potassium tend to be weighed as sodium, so that when the amount of sodium is small an appreciable error is introduced, which may be relatively large as the quantity of sodium approaches zero. The following data were obtained by flame photometry and are believed to represent a new order of accuracy in figures for sodium.

In spite of the character of the individual analyses, it must be kept in mind that the figures represent only single samples or at most a few samples of the material examined. For this reason, the findings are reported in no more than two significant figures, and only in one significant figure when the content is less than 10 mg. per 100 grams. The individual samples were analyzed in duplicate. Emphasis was given to unprocessed or slightly processed foods, rather than to culinary creations in which the use of salt and other sodium compounds is highly variable. Brand names of manufactured products are given only when their use is unavoidable, but in general leading brands are represented.

It will be noted that natural foods usually contain less sodium than those which have been processed. For example, fresh peas are almost sodium-free, but canned, frozen and dry split peas contain large amounts of added sodium. Sodium compounds are so widely used in processing foods, and their use in most circumstances is so harmless, that the pure food laws do not require label declarations in many instances. Foods labeled as containing salt should of course be avoided in low sodium diets, but the absence of such label statements is no guarantee that large amounts of sodium are not present.

As a rule, fresh foods of vegetable origin contain little sodium, while foods of animal origin contain much sodium, even when none is added. Thus the protein sources having the highest biological value are also the high sodium foods—meat, eggs and milk. The low sodium product Lonalac was specially designed to provide a protein food of animal origin suitable for liberal use in low sodium diets.

Values for potassium are included for the benefit of research workers interested in the role of this element. Information on many foods not listed is available on request. Physicians should bear in mind that the listing of any given food as of low sodium content does not imply that such food is in every other respect a suitable one for all patients. Attention is called to the listing of public water supplies at the end of these tables, because drinking water in some communities is a significant source of dietary sodium.

Table 106

FOOD*	Na, MG. PER 100 GM.	K, MG. PER 100 GM.
Allspice, ground	62	680
Almond	2	690
Almond, roasted in oil and salted	160	710
Anchovy paste	12,000	1,900
Apple juice (sweet cider), bottled	4	100
Apple, less skin	0.1	68
Applesauce, canned	0.3	55
Apricot	0.5	440
Apricot, canned in sirup	2	65
Asparagus, spears, canned	400	130
Asparagus, tips	2	240
Asparagus, tips, frozen	3	320
Avocado	2	340
Bacon	760	95
Bacon, fried crisp	3,200	450
Banana	0.1	400
Barley, pearled	3	160
Bean, Great Northern, dry	0.3	1,400
Bean, green	0.8	300
Bean, green, canned	410	120
Bean, green, frozen	2	110
Bean, Lima	1	680
Bean, Lima, canned	310	210
Bean, navy, dry	0.9	1,300
Beef, corned	1,700	400
Beef, dried	3,900	1,000
Beef, less excess fat	53	380
Beer	8	46
Beet	110	350
Beet, canned	36	120
Beet leaves	130	570
Blackberry	0.2	150
Blueberry	0.5	89
Bouillon cube	27,000	1,500
Brain, pig	150	340
Brandy	3	4
Brazil nut	0.8	650
Brazil nut, roasted in oil and salted	190	730
Bread, low sodium, (made with Lonalac)	2	120
Bread, low sodium, cinnamon roll	2	120
Bread, Passover. See matzoth	------	------
Bread, rye and wheat	560	100
Bread, semi-whole-wheat	670	300
Bread, wheat, white	670	130
Bread, whole wheat	430	210
Broccoli	16	400
Brussels sprouts	11	450
Brussels sprouts, frozen	9	300
Butter, average salted. Theoretical value based on U.S. average salt content of 2.5%	980	------
Butter, lightly salted	780	16
Butter, unsalted	5	4
Buttermilk, cultured	130	140
Cabbage	5	230
Cantaloupe	12	230
Caraway seed	16	1,400
Carrot	31	410
Carrot, canned	280	110
Cashew nut	13	560
Cashew nut, roasted in oil and salted	200	560
Catchup, tomato	1,300	800
Catfish (fiddler)	60	330
Cauliflower, bud	24	400
Cauliflower, bud, frozen	22	290
Caviar, salmon	2,200	640
Celery salt	26,000	3,100
Celery, seed	140	1,400
Celery, stalks	110	300
Cereal, bran	1,400	1,200
Cereal, wheat, Instant Ralston	1	360
Cereal, wheat, Maltex	4	250
Cereal, wheat, Pettijohn's	2	380
Cereal, wheat, Wheatena	1	380
Cheese, American Swiss	420	110
Cheese, cheddar	540	130
Cheese, cottage	320	80
Cheese, cream	340	90
Cheese, process	1,500	440
Cheese, whey (cheese food)	1,500	520
Cherry, dark sweet	1	260
Cherry, dark sweet, canned in sirup	0.7	77
Cherry, dark sweet, frozen in sirup	1	280
Cherry, light sweet, canned in sirup	3	55
Chestnut	2	410
Chicken, breast meat	78	320

*Edible portions only. Fresh, uncooked material unless otherwise described.

Table 106—Cont'd

FOOD	Na, MG. PER 100 GM.	K, MG. PER 100 GM.
Chicken, leg meat	110	250
Chocolate, milk	86	420
Chocolate sirup	60	130
Chocolate, unsweetened	4	830
Cider, sweet (apple juice)	4	100
Cinnamon, ground	8	200
Citron, candied	290	70
Clam	180	240
Coca-Cola (soft drink)	1	52
Cocoa, powder, Dutch process	55	3,200
Cocoa, powder, ordinary, Hershey	4	1,400
Coconut, dry, shredded	16	770
Cod	60	360
Cod, frozen fillets	400	400
Cod liver oil	0.1	0
Cod, salted	7,200	80
Coffee, roasted	2	1,600
Corn flakes	660	160
Corn meal, yellow, enriched	0.6	120
Corn oil	0.2	0.1
Corn, popcorn, popped and oiled	3	320
Corn, popcorn, popped, oiled and salted	1,500	340
Corn starch	4	4
Corn, sweet white, canned	200	200
Corn, sweet white, milk stage	0.2	240
Corn, sweet yellow, canned	210	200
Corn, sweet yellow, frozen	9	190
Corn, sweet yellow, milk stage	0.3	370
Corn, yellow, 5 varieties, dry	0.4	290
Cowpea	1	560
Crab, canned	1,000	72
Cracker, Graham	700	440
Cracker, soda	1,500	500
Cranberry	1	65
Cranberry sauce, canned	1	17
Cream, whipping (32% fat)	40	56
Cucumber, less parings	0.8	230
Currant	2	160
Currant, Zante, dried (Zante raisins)	22	730
Curry powder	45	1,300
Dandelion	76	430
Date, semi-dry	0.9	790
Dextrin	14	14
Dextrose	1	0.4
Dill, seed	12	1,000
Duck, domesticated, breast meat	68	360
Duck, domesticated, leg meat	96	210
Egg	140	130
Egg, whites only	200	140
Egg, yolks only	34	85
Eggplant	0.8	190
Endive	18	400
Farina	0.8	88
Farina, quick-cooking enriched	100	95
Fig	2	190
Fig, canned in sirup	1	110
Fig, dried	33	780
Filbert	0.8	560
Flour, bleached, enriched, Gold Medal	1	86
Flour, bleached, enriched phosphated	13	78
Flour, buckwheat	1	680
Flour, gluten	2	24
Flour, rye, dark	1	860
Flour, white, natural	1	120
Fruit cocktail, canned in sirup	9	160
Garlic	6	510
Gelatin dessert, dry	330	210
Gelatin, plain, dry	27	11
Gin	0.7	0.3
Ginger ale	8	0.6
Ginger, ground	29	1,100
Gizzard, turkey	58	170
Gluten, wheat	2	24
Gooseberry	0.6	87
Grape juice, Concord, sweetened, bottled	1	120
Grape, Thompson Seedless	4	180
Grapefruit	0.4	200
Grapefruit juice, sweetened, canned	0.4	150
Gravy flavoring	86	280
Halibut	56	540
Ham, less excess fat	2,100	610

TABLE 106—CONT'D

FOOD	Na, MG. PER 100 GM.	K, MG. PER 100 GM.	FOOD	Na, MG. PER 100 GM.	K, MG. PER 100 GM.
Hash, corned beef, canned	880	380	Milk, whole, liquid	51	140
Heart, beef	90	160	Molasses, cane	80	1,500
Heart, turkey	69	240	Mulberry	0.6	200
Hominy, canned	180	50	Mushroom	5	520
Honey	7	10	Mushroom, canned	470	260
Horse-radish, prepared	96	290	Mustard greens	48	450
Ice cream, vanilla	100	90	Mustard, powder	3	840
Jam, grape	7	78	Mustard, prepared paste	1,100	280
Kale	110	410	Nutmeg, ground	14	160
Kidney, beef	210	310	Oats, rolled	2	340
Lamb, less excess fat	110	340	Okra, pods	1	220
Lard	0.3	0.2	Oleomargarine	1,200	230
Lemon, less rind	0.6	130	Olive, green pickled	2,200	290
Lettuce, head	12	140	Olive oil	0.2	0.2
Litchi, dried	3	1,100	Olive, ripe pickled	920	240
Liver, calf	110	380	Onion, white	1	130
Liver, pig	77	350	Orange	0.2	170
Liver, turkey	51	160	Orange Crush (soft drink)	2	100
Lobster, boiled in tap water	210	180	Orange juice, unsweetened, canned	0.4	190
Lonalac	20	1,200	Oyster, fresh	73	110
Lonalac, reliquefied	2	160	Pancreas, pig	57	240
Macaroni	1	160	Paprika, powder	82	2,300
Mace, ground	45	180	Parsley	28	880
Maize. See corn	------	------	Parsnips	7	740
Maple sirup	14	130	Pea	0.9	380
Marmalade, orange	13	19	Pea, canned, less liquor	230	180
Matzoth, American style	360	130	Pea, dry split	42	880
Matzoth, egg	16	160	Pea, frozen	100	160
Matzoth farfel	28	130	Peach	0.1	180
Matzoth meal	4	125	Peach, canned in sirup	6	31
Matzoth, Passover	1	140	Peach, frozen in sirup	3	120
Matzoth, plain	1	140	Peanut butter	120	820
Matzoth, poppy seed	350	140	Peanut oil	0.2	0.1
Matzoth, tasty wafer	430	260	Peanut, roasted in oil and salted	460	700
Matzoth, thin tea	2	130	Peanut, roasted in shell	0.8	740
Matzoth, whole wheat	280	420	Pear, Bartlett	2	100
Mayonnaise	600	17	Pear, canned in sirup	8	52
Milk, buttermilk, cultured	130	140	Pecan	0.2	420
Milk, dialyzed. Replaced by Lonalac	------	------	Pepper, black, ground (spice)	16	880
Milk, evaporated	100	270	Pepper, green (vegetable)	0.5	170
Milk, goat	34	180	Pepper, red, ground (spice)	46	2,400
Milk, human, from 9 mothers, 3 to 10 days postpartum	40	64	Pepper, white, ground (spice)	5	48
Milk, human, from 4 mothers, 49 to 77 days postpartum	11	51	Persimmon, wild	0.8	340
Milk, malted	440	720	Pickle, dill	2,300	330
Milk, whole, dry	410	1,100	Pilchard. See sardine	------	------

TABLE 106—CONT'D

FOOD	Na, MG. PER 100 GM.	K, MG. PER 100 GM.	FOOD	Na, MG. PER 100 GM.	K, MG. PER 100 GM.
Pineapple	0.3	210	Rum	2	3
Pineapple, canned in sirup	1	120	Sage	19	670
Pineapple, frozen in sirup	1	38	Salmon	48	410
Pineapple juice, unsweetened, canned	0.4	140	Salmon, canned	470	330
Plum	0.1	140	Salt, common. Theoretical value for pure NaCl	39,342	0
Plum, canned	18	110	Sardine (herring), canned in oil	510	560
Pomegranate, juice and pulp	0.3	200	Sardine (pilchard), canned in natural sauce	760	260
Popcorn, popped and oiled	3	320	Sardine (pilchard), canned in tomato sauce	400	320
Popcorn, popped, oiled and salted	1,500	340	Sauerkraut, canned	730	490
Pork, less excess fat	58	260	Sausage, Bologna	220	84
Pork, salt	2,900	260	Sausage, Frankfurt	1,100	330
Postum (cereal beverage), dry	36	1,300	Sausage, pork	1,100	440
Postum, instant, dry	71	2,200	Shortening, vegetable, Crisco	4	0
Potato chips	340	880	Shortening, vegetable, Spry	0.4	0.2
Potato, sweet, canned	48	200	Shrimp	140	220
Potato, sweet, less skin	4	530	Sirup, chocolate	60	130
Potato, white, canned	350	240	Sirup, maple	14	130
Potato, white, less skin	0.6	410	Sirup, sorghum	20	600
Poultry seasoning	26	840	Sirup, table (corn-and-cane)	83	24
Pretzel	1,100	330	Soda, baking. Theoretical value for pure $NaHCO_3$	27,373	0
Prune, canned in sirup	3	220	Sorghum sirup	20	600
Prune, dried	5	600	Soup, beef, canned. Diluted as served	400	244
Prune juice, unsweetened	2	260	Soup, tomato, canned. Diluted as served	400	440
Pumpkin	0.4	480	Soup, vegetable, canned. Diluted as served	150	170
Pumpkin, canned	2	240	Soybean, dry	4	1,900
Quail, breast meat	35	160	Soy flour, solvent-extracted	0.6	1,700
Quail, leg meat	44	190	Spaghetti. See Macaroni	------	------
Quince	0.6	290	Spinach	190	790
Rabbit, domesticated, foreleg	47	370	Spinach, canned	300	260
Rabbit, domesticated, loin	34	400	Spinach, frozen	60	330
Radish, with skin	8	260	Squash, acorn	0.3	260
Raisin, seedless	21	720	Squash, Hubbard	0.2	240
Raisin, Zante	22	730	Squash, yellow summer	0.5	200
Raspberry, black	0.2	190	Squash, white summer	0.2	150
Raspberry, oriental (wineberry)	0.8	170	Starch, corn	4	4
Raspberry, red	0.4	130	Strawberry	0.7	180
Rhubarb, stalks	1	70			
Rice flakes	720	180			
Rice, puffed	0.8	100			
Rice, polished and coated	2	130			
Rice, vitaminized	4	170			

TABLE 106—CONT'D

FOOD	Na, MG. PER 100 GM.	K, MG. PER 100 GM.	FOOD	Na, MG. PER 100 GM.	K, MG. PER 100 GM.
Strawberry, frozen, sweetened	2	180	Veal, less excess fat	48	330
Sugar, light brown	24	230	Vinegar, cider	1	100
Sugar, white	0.3	0.5	Vinegar, distilled	0.6	15
Tangerine	2	110	Walnut, black	2	460
Tangerine, juice sweetened, canned	0.6	170	Walnut, English	2	450
Tapioca, granules	5	19	Water, carbonated, I	18	0.6
Tea, India-Ceylon-Java blend	4	1,800	Water, carbonated, II	1	0.6
Thyme, whole	36	500	Watermelon	0.3	110
Tobacco, chewing	1,600	1,800	Wheat flakes	1,000	540
Tomato	3	230	Wheat germ, containing some bran and flour	2	780
Tomato, canned	18	130	Wheat gluten	2	24
Tomato juice, canned	230	230	Wheat, puffed	3	340
Tongue, beef	100	260	Wheat, shredded	2	340
Tripe, pickled	46	19	Wheat, winter	2	430
Tuna, canned	540	480	Whisky, blended	0.3	1
Turkey, breast meat	40	320	Whisky, bonded	0.1	0.6
Turkey, leg meat	92	310	Wine, port	4	75
Turmeric	21	2,700	Wine, sauterne	10	87
Turnip, leaves	10	440	Wineberry	0.8	170
Turnip, white	37	230	Worcestershire sauce	1,400	360
Turnip, yellow (rutabaga)	5	260	Yeast, compressed	4	360
Vanilla extract	1	74	Yeast, debittered, dry	180	1,900
			Yeast, primary cultured, dry	8 to 320	2,000
			Zwieback	250	170

See also discussion by Bills et al.: J. Am. Dietet. A. 25: 304, 1949.

Table 106 A

Mead Johnson & Co. Products

	Na, mg. per 100 gm.	K, mg. per 100 gm.
Alacta (half-skim milk), dry	520	1,400
Amigen, dry	1,600	270
Amigen 5% in 5% Dextrose Solution	150	29
Amigen, 10% Solution	240	68
Casec (calcium caseinate)	42	21
Dextri-Maltose No. 1	830	220
Dextri-Maltose No. 2	44	160
Dextri-Maltose No. 3	45	1,300
Dextri-Maltose with Yeast Extract and Iron	52	360
Lactic Acid Milk Half Skim, dry	440	1,300
Lactic Acid Milk No. 2, dry	400	1,100
Lonalac, dry	20	1,200
Lonalac, reliquefied	2	160
Nutramigen, dry	380	960
Olac, dry	270	680
Pabena, dry	650	500
Pablum, dry	670	360
Pectin-Agar in Dextri-Maltose	750	200
Protein Milk, dry	460	650
Protenum, dry	360	1,100
Protolysate, dry	1,500	400
Sobee, dry	430	1,300
Yeast, Brewers	8 to 320	2,000

Public Water Supplies

Inasmuch as the sodium content of water may be appreciable, it becomes advisable to check the value when sodium restriction is produced.

Assuming an average daily consumption of 2 liters of water in food and drink, it follows that if the water contains as much as 25 mg. of sodium per 100 c.c., the patient will receive 500 mg. of sodium from water alone, and a diet limited to this amount becomes impossible. It would be a safe rule to use only distilled or de-ionized water for sodium-restricted patients wherever the municipal supply contains more than 3 mg. of sodium per 100 c.c.

Fortunately, the municipal water supplies of many cities are so low in sodium that they are entirely suitable for use in low sodium diets. There are, however, some outstanding exceptions. Hardness or softness has no bearing on the sodium content of water, except that when hard water is softened by base-exchange apparatus the calcium and magnesium are replaced by sodium in the ratio of 2 atoms of sodium for each atom of calcium or magnesium. Therefore, water which has been softened is always suspected as regards its suitability for low sodium diets and for the preparation of reliquefied Lonalac.

The following table gives the sodium (and potassium) content of the waters of representative cities. Included are the principal cities of the United States, the capitals of the states and many places important as medical centers. The samples were mostly taken in the winter and spring of 1947, and the analyses were made with the flame photometer. Seasonal variations are known to occur, especially in river waters, but river waters rarely contain much sodium.

Additional data on public water supplies can be obtained from the various state and municipal laboratories, and from a United States Government bulletin compiled some years ago, "The Industrial Utility of the Public Water Supplies in the United States, 1932" (Geological Survey, United States Department of the Interior, Water-Supply Paper 658, Washington, D. C., Government Printing Office, 1934; order from Superintendent of Documents, 25 cents).

TABLE 106 B

PLACE	Na, MG. PER 100 C.C.	K, MG. PER 100 C.C.	PLACE	Na, MG. PER 100 C.C.	K, MG. PER 100 C.C.
Aberdeen, S. D.	20	2	Buffalo, N. Y.	0.7	0.3
Albany, N. Y.	0.2	0.2	Burlington, Vt.	0.2	0.1
Albuquerque, N. M.	5	0.7	Carson City, Nev.	0.4	0.3
Annapolis, Md.	0.2	0.2	Charleston, S. C.	1	0.3
Ann Arbor, Mich.	2	0.5	Charleston, W. Va.	0.3	0.2
Atlanta, Ga.	0.2	0.2	Charlotte, N. C.	0.3	0.1
Augusta, Maine	0.2	0.2	Charlottesville, Va.	0.2	0.1
Austin, Texas	3	0.5	Cheyenne, Wyo.	0.3	0.2
Baltimore, Md.	0.3	0.2	Chicago, Ill.	0.3	0.1
Bangor, Maine	0.2	0.1	Cincinnati, Ohio	0.7	0.3
Baton Rouge, La.	9	0.2	Cleveland, Ohio	1	0.3
Beloit, Wis.	0.5	0.2	Columbia, S. C.	0.4	0.2
Biloxi, Miss.	23	0.6	Columbus, Ohio	5	0.6
Birmingham, Ala.	2	0.3	Concorn, N. H.	0.2	0.1
Bismarck, N. D.	6	0.6	Crandall, Texas	170*	0.5
Boise, Idaho	2	0.3	Dallas, Texas	3	0.5
Boston, Mass.	0.3	0.2	Denver, Colo.	3	0.2
Brownsville, Texas	6	0.3	Des Moines, Iowa	1	0.4

*An extreme example. This water is rarely drunk, but is used for cooking.

Table 106 B—Cont'd

Place	Na, mg. per 100 c.c.	K, mg. per 100 c.c.
Detroit, Mich.	0.3	0.1
Dover, Del.	2	0.5
Durham, N. C.	0.4	0.2
El Paso, Texas	7	0.6
Ephrata, Pa.	0.3	0.2
Evansville, Ind.	2	0.5
Fargo, N. D.	5	0.7
Frankfort, Ky.	0.3	0.1
Galesburg, Ill.	30	2
Galveston, Texas	34	0.7
Harrisburg, Pa.	0.2	0.1
Hartford, Conn.	0.2	0.1
Helena, Mont.	0.3	0.2
Houston, Texas	16	0.6
Huntington, W. Va.	3	0.2
Indianapolis, Ind.	1	0.3
Iowa City, Iowa	0.5	0.3
Jackson, Miss.	0.4	0.2
Jacksonville, Fla.	1	0.2
Jefferson City, Mo.	3	0.4
Jersey City, N. J.	0.3	0.2
Kansas City, Kan.	4	0.4
Kansas City, Mo.	10	3
Lansing, Mich.	1	0.5
Lincoln, Neb.	3	0.7
Little Rock, Ark.	0.1	0.1
Los Angeles, Calif.:		
Aqueduct source	6	0.6
Metropolitan source	17	0.6
River source	5	0.5
Louisville, Ky.	2	0.3
Madison, Wis.	0.4	0.2
Manchester, N. H.	0.2	0.1
Marion, Ohio	17	0.7
Memphis, Tenn.	2	0.3
Miami, Fla.	2	0.3
Milwaukee, Wis.	0.3	0.1
Minneapolis, Minn.	0.5	0.3
Minot, N. D.	25	0.6
Montgomery, Ala.	0.8	0.1
Montpelier, Vt.	0.1	0.1
Nashville, Tenn.	0.3	0.2
Nevada, Mo.	33	0.7
Newark, N. J.	0.2	0.1
New Haven, Conn.	0.3	0.1
New Orleans, La.	1	0.4
New York, N. Y.	0.3	0.2
Oakland, Calif.	0.3	0.1
Oklahoma City, Okla.	10	0.8
Olympia, Wash.	0.5	0.3
Omaha, Neb.	8	1
Philadelphia, Pa.	2	0.4
Phoenix, Ariz.	11	0.7
Pierre, S. D.	9	0.5
Pittsburgh, Pa.	6	0.5
Portland, Maine	0.2	0.1
Portland, Ore.	0.1	0.1
Providence, R. I.	0.2	0.1
Raleigh, N. C.	0.4	0.1
Reno, Nev.	0.5	0.1
Richmond, Va.	0.7	0.2
Rochester, Minn.	0.7	0.2
Rochester, N. Y.	0.3	0.2
Sacramento, Calif.	0.3	0.2
Santa Fe, N. M.	0.4	0.1
St. Louis, Mo.	5	0.5
St. Paul, Minn.	0.5	0.3
Salem, Ore.	0.2	0.1
Salt Lake City, Utah	0.8	0.2
San Diego, Calif.	5	0.5
San Francisco, Calif.	1	0.3
Seattle, Wash.	0.2	0.1
Sioux Falls, S. D.	1	0.4
Springfield, Ill.	0.8	0.3
Syracuse, N. Y.	0.2	0.1
Tallahassee, Fla.	0.3	0.1
Topeka, Kan.	1	0.5
Trenton, N. J.	0.1	0.1
Tucson, Ariz.	3	0.3
Washington, D. C.	0.3	0.3
Wichita, Kan.	5	0.5
Wilmington, Del.	0.8	0.1

TABLE 107

SODIUM CHLORIDE CONTENT OF FOOD

Salt adjustment is necessary in several conditions, and while the sodium chloride content, and the content of any other mineral, of a food varies with the variety, mode of preparation, and environmental conditions under which grown, it is possible to approximate the content of the natural food.

All corned, pickled, smoked, and salted foods have a high sodium chloride content.

Bananas, bread, butter, crackers, egg white, meat stock, meat broth, meat extracts, cheese and milk, molasses, and oysters are rich sources of sodium chloride.

Cereals, fruits, and vegetables, in general, are poor sources.

For sodium content of foods see Table 106

Approximate values are given for some common foods:

KIND OF FOOD	GM. NaCl PER 100 GM. NATURAL FOOD
Cereals and Cereal Products	
Barley	0.04
Bread, white	0.70-1.0
Corn	0.30
Macaroni	0.7-1.04
Oats, rolled	0.10-0.35
Rice	0.04
Rye	0.015
Dairy Products	
Butter, salted	1.0-3.0
Cheese	1.0-5.0
Egg, yolk	0.04
Egg, white	0.31
Milk	0.18-0.25
Fish	
Cod, fresh	0.16
Cod, salt	3.4
Haddock	0.39
Pickerel	0.10
Salmon	0.12
Fruits	
Apricots	0.005
Grapes	0.025
Pineapple	0.07
Plums	0.005
Raisins	0.16
Strawberries	0.19
Watermelon	0.01
Meats	
Bacon	1.0
Beef	0.11
Chicken	0.14
Goose	0.20
Liver, calf	0.14
Mutton	0.17
Pork	0.10
Veal	0.13

TABLE 107—CONT'D

KIND OF FOOD	GM. NaCl PER 100 GM. NATURAL FOOD
Miscellaneous, prepared in the usual way	
Beef broth	0.73
Chicken soup	0.50
Pea soup	0.35
Soup stock	0.76
Vegetables	
Asparagus, fresh	0.04-0.06
Asparagus, canned	0.83
Beans, fresh	0.09
Beans, canned	0.77
Cabbage, fresh	0.03-0.75
Cauliflower	0.05-0.15
Celery	0.2-0.5
Lettuce	0.1
Onion	0.02-0.30
Peas, fresh	0.06
Peas, canned	0.67
Potato	0.10-0.15
Tomato	0.10

TABLE 108

PURINE CONTENT OF VARIOUS FOODS (J. SCHMID AND G. BESSAU)*

100 GM.	BASES N IN GRAMS	URIC ACID IN GRAMS
Meat		
Beef	0.037	0.111
Veal	0.038	0.114
Mutton	0.026	0.078
Pork	0.041	0.123
Boiled ham	0.025	0.075
Smoked ham	0.024	0.072
Smoked salmon	0.017	0.051
Smoked tongue	0.055	0.165
Liver-wurst	0.038	0.114
Blutwurst	0	0
Brains	0.028	0.084
Liver	0.093	0.279
Kidney	0.080	0.240
Sweetbreads	0.330	0.990
Lungs	0.052	0.156
Chicken	0.029	0.087
Squab	0.058	0.174
Goose	0.033	0.099
Venison	0.039	0.117
Pheasant	0.034	0.102
Bouillon (100 gm. beef)	0.015	0.045
Fish		
Shell fish	0.039	0.117
Codfish	0.038	0.114
Eel (smoked)	0.027	0.081
Salmon (fresh)	0.024	0.072
Carp	0.054	0.162
Pike	0.045	0.135
Pike	0.048	0.144
Red herring	0.028	0.084
Herring	0.069	0.207
Trout	0.056	0.168
Sprot	0.082	0.246
Sardines	0.118	0.354
Sardel	0.078	0.234
Anchovies	0.145	0.465
Crabs	0.020	0.060
Oysters	0.029	0.087
Lobster	0.022	0.066
Eggs		
Hen's eggs	0	0
Caviar	0	0
Shad roe	0	0
Milk and Cheese		
Milk	0	0
Edam cheese	0	0
Swiss cheese	0	0
Limburger cheese	0	0
Tilsit cheese	0	0

100 GM.	BASES N IN GRAMS	URIC ACID IN GRAMS
Roquefort cheese	0	0
Cream cheese	0.005	0.015
Dairy cheese	0.022	0.066
Vegetables		
Cucumber	0	0
Lettuce	0.003	0.009
Radish	0.005	0.015
Cauliflower	0.008	0.024
Garlic	Traces	Traces
Spinach	0.024	0.072
Carrot	0	0
Green cabbage	0.002	0.006
Red cabbage	0.002	0.006
Rape-cale	0.011	0.033
Celery	0.005	0.015
Asparagus	0.008	0.024
Onions	0	0
String beans	0.002	0.006
White potatoes	0.002	0.006
Shell beans	0.027	0.081
Peas	0.018	0.054
Lentils	0.054	0.162
Beans	0.017	0.051
Mushrooms	0.018	0.054
Fruit		
Bananas	0	0
Pineapple	0	0
Peaches	0	0
Grapes	0	0
Tomatoes	0	0
Pears	0	0
Plums	0	0
Whortle berries	0	0
Oranges	0	0
Apricots	0	0
Blueberries	0	0
Apples	0	0
Alomus	0	0
Hazelnuts	0	0
Walnuts	0	0
Cereals		
Grits	0	0
Barley	0	0
Rice	0	0
Tapioca	0	0
Sago	0	0
Oatmeal	0	0
Millet	0	0
Rolls	0	0
Light bread	0	0

*From *Therapeusis of Internal Diseases* by Forchheimer: D. Appleton-Century Co.

TABLE 109

CHOLESTEROL CONTENT OF FOODS*

Mg. per 100 Gm. fresh material

	MG. %
Bacon	38-78
Beef	38-78
Brain	2,130-3,700
Chicken	59-527
Kidney	200-3,400
Liver	130-3,400
Pancreas	3,120
Pork	46-48
Veal	84-88
Fish	21-95
Oyster	215
Salmon roe	2,200
Bacon fat	108
Butter	185-340
Cod liver oil	400
Fats—lard, suet	100-350
Milk, cow's, whole	12
Milk, cow's, skim	2
Cheese	42-88
Egg, whole	240-490
Egg yolk	1,180-2,150

*Data on cholesterol content of foods lack uniformity. Values here are compiled from data by Twiss and Greene: J. A. M. A. **101**: 1841, 1933, and summary from Cook: Nutrition Abstr. & Rev. **12**: 1, 1942. Cholesterol is an animal product; it does not occur in plants or in lipids derived from plants. See also Okey, Ruth: Cholesterol Content of Foods, J. Am. Dietet. A. **21**: 341, 1945; and Mann, George V.: Dietary Aspects of Cholesterol Metabolism and Disease, J. Am. Dietet. A. **25**: 389, 1949.

TABLE 110

WATER CONTENT OF FOODS

High (70% or more)	*Low*
Beverages	All dried fruits used as such; cooking restores the water
Fresh fruits	Prepared cereals
Fruit juices	Crackers
Leafy vegetables	Sugars
Milk	Fats
Soups	Nuts
Ice cream	Starches
Gelatin desserts	Solid cheeses

TABLE 111

FOODS CONTAINING OXALIC ACID*

Beet greens	Purslane
Gooseberries	Rhubarb
Lamb's-quarters	Spinach
Poke	Swiss chard
Poppy seed	

TABLE 112

KETO-ANTIKETOGENIC FOODS

Ketogenic	*Antiketogenic*
Meats	Sugars
Fats	Starches
Some fish	Cereals
Egg yolk	Milk
Cheese	Fruits
Nuts	Vegetables

TABLE 113

BULK CONTENT OF FOODS

Bulky	*Low Residue*
Whole grain cereals	Finely milled cereals
Fruits as purchased	Fruit juices
Leafy green vegetables	Puréed vegetables
	Milk
	Cheese
	Meats
	Eggs

*Kohman: Oxalic Acid in Foods; J. Nutr. 18: 233, 1939.

TABLE 114

EXCESS OF ACID-FORMING OR BASE-FORMING ELEMENTS

ARTICLE OF FOOD	EXCESS ACID OR BASE IN TERMS OF NORMAL SOLUTIONS			
	PER 100 GRAMS		PER 100 CALORIES	
	ACID (C.C.)	BASE (C.C.)	ACID (C.C.)	BASE (C.C.)
Almonds		12.38		1.86
Almonds		11.76		1.76
*Apples		3.76		5.98
Asparagus		0.81		3.65
Bananas		5.56		5.62
Beans, dried		23.87		6.92
Beans, dried		11.58		3.36
Beans, Lima, dried		41.65		12.08
Beets		10.86		23.57
Cabbage		4.34		13.76
Cabbage		7.10		22.51
Carrots		10.82		23.91
Cauliflower		5.33		17.48
Celery		7.78		12.17
Cherry juice		4.40		
Chestnuts		7.42		3.19
Corn, sweet, dried	5.95		1.77	
Crackers	7.81		1.95	
Currants, dried		5.97		1.85
Eel	9.89			
Eggs	11.10		7.55	
Egg white	5.24		9.52	
Egg yolk	26.69		7.08	
Fish, haddock	16.07			
Fish, pike	11.81			
Lemons		5.45		12.32
Lettuce		7.37		38.69
Meat, beef, lean I	13.91		12.10	
beef, lean II	10.05		8.74	
beef, lean	12.00		10.44	
beef, lean	13.67		11.89	
chicken	17.01			
frog	10.36			
pork, lean	11.87			
rabbit	14.80			
veal	13.52			
venison	15.83			
Milk, cow's		2.37		3.44
Milk, cow's		1.26		1.83
*Muskmelon		7.47		18.82
Oatmeal	12.93		3.23	
Oatmeal	10.63		2.66	
*Oranges		5.61		10.94
Peaches		5.04		12.20
Peanuts	3.9		0.70	
Peas, dried		7.07		1.98
Peas, dried		3.36		0.94
*Potatoes I		7.19		8.63
*Potatoes II		5.5		

TABLE 114—CONT'D

ARTICLE OF FOOD	EXCESS ACID OR BASE IN TERMS OF NORMAL SOLUTIONS			
	PER 100 GRAMS		PER 100 CALORIES	
	ACID (C.C.)	BASE (C.C.)	ACID (C.C.)	BASE (C.C.)
Potatoes		7.72		9.26
Prunes		24.40		8.05
Prunes		25.55		8.43
Radishes		2.87		9.79
*Raisins		23.68		6.87
Raspberry juice		4.91		
Rice I	8.1		3.35	
Rice II	7.08		2.05	
Rice	8.35		2.42	
Turnips		2.68		6.86
Turnips		6.80		9.41
Wheat, entire	9.66		3.25	
Wheat, entire	12.39		3.47	
Wheat, flour	11.61		2.70	

*Have been found experimentally by Blatherwick to be particularly effective in reducing the acidity of the urine.

Reproduced from Sherman and Gettler: J. Biol. Chem. 11: 323, 1912. Courtesy of Dr. Sherman and the Journal. Dr. Sherman, in granting permission, writes: "In using these figures it should be quite clear that they are arrived at by calculations from the analyses, which calculations involve assumptions, so that the figures should be taken only as general guides." These figures are, however, of value in adjusting urinary pH by means of diet.

Table 115

Composition of Human Blood*

Constituent	Normal range mg per 100 ml.†	Pathological conditions in which increases (unless otherwise noted) may be encountered
Total solids, per cent	19-23	Anhydremia. Low in hydremic plethora and anemia
Total proteins (serum), per cent	6.5-8.2	Low in nephritis with edema (nephrosis)
Albumin (serum), per cent	4.6-6.7	Low in nephrosis
Globulin (serum), per cent	1.2-2.3	Nephrosis, anaphylactic conditions, malignancy, infections, muscular activity
Fibrinogen (plasma), per cent	0.3-0.6	Pneumonia, infections. Low in cirrhosis of liver, chloroform or phosphorus poisoning, typhoid fever
Hemoglobin, per cent (Haden)	15.6	Polycythemia. Low in primary and secondary anemia, chlorosis
Iron, as Fe	52	See Hemoglobin
Copper	0.05-0.25	
Total nitrogen, per cent	3.0-3.7	Varies chiefly with proteins (albumin, globulin, hemoglobin)
Nonprotein N	25-35	Nephritis, eclampsia, etc. See Urea N
Urea N	10-15	Chronic and acute nephritis, metallic poisoning, cardiac failure, intestinal or prostatic obstruction, some infectious diseases. Relatively low in nephrosis
Uric acid	2.0-3.5	Nephritis, gout, arthritis, eclampsia
Creatinine	1-2	Nephritis
Creatine	3-7	Terminal nephritis
Amino-acid N	5-8	Leukemia, acute yellow atrophy of the liver, severe nephritis
Ammonia N	0.1-0.2	Terminal interstitial nephritis
Undetermined N	4-18	Eclampsia
Glucose	70-100	Diabetes, pregnancy, severe nephritis
Total fatty acids	290-420	Diabetes, nephritis
Cholesterol	150-190	Diabetes, nephritis, nephrosis, biliary obstruction, pregnancy. Low in pernicious anemia
Lipid phosphorus	12-14	Diabetes, nephritis, pregnancy. In anemia, low in plasma, high in cells
Total acetone bodies (as acetone)	0.8-5.0	Diabetes
Acetone + aceto-acetic acid (as acetone)	0.3-2.0	Diabetes
β-Hydroxybutyric acid (as acetone)	0.5-3.0	Diabetes
Bilirubin	0.1-0.25	Biliary obstruction, hemolytic anemias. Low in secondary anemia
CO_2 capacity (plasma) vol. per cent	55-75‡	Respiratory diseases, tetany. Low in diabetes, nephritis
CO_2 content (arterial blood) vol. per cent	45-55‡	Respiratory diseases, tetany. Low in diabetes, nephritis.
CO_2 content (venous blood) vol. per cent	50-60‡	Respiratory diseases, tetany. Low in diabetes, nephritis.
O_2 capacity vol. per cent	16-24‡	Polycythemia, anhydremia. Low in cardiac and respiratory diseases, anemia
O_2 content (arterial blood) vol. per cent	15-23‡	Polycythemia, anhydremia. Low in cardiac and respiratory diseases, anemia
O_2 content (venous blood) vol. per cent	10-18‡	Polycythemia, anhydremia. Low in cardiac and respiratory diseases, anemia
Ascorbic acid	0.8-2.4	Low in scurvy
Lactic acid	5-20	Exercise, eclampsia
Phenols (free)	1-2	Intestinal obstruction, pernicious anemia, nephritis
Chlorides as NaCl	450-500	Nephritis, cardiac conditions, prostatic obstruction, eclampsia, enemia. Low in diabetes, fever, and pneumonia
Sulfates, inorganic as S (serum)	0.9-1.1	Nephritis
Phosphorus inorganic as P (plasma)	3-4	Nephritis. Low in rickets. Normal values 1-2 mg. higher in children
Calcium (serum)	9.0-11.5	Low in infantile tetany, severe nephritis, parathyroidectomy
Magnesium (serum)	1-3	No changes noted in disease
Sodium (serum)	330	Low in cases of alkali deficit
Potassium (serum)	16-22	Pneumonia, acute infections, occasionally in uremia
Iodine, γ per 100 ml.	8-15	Hyperthyroidism. Low in cretinism

*From Hawk, Oser, and Summerson: Physiological Chemistry, ed. 12, Philadelphia, 1947, The Blakiston Company.

†Figures express concentration in mg. per 100 ml. of whole blood unless otherwise indicated in the first column.

‡Figures represent weighted averages of the observations of several investigators.

Table 116

Physiological Constituents of Urine*

Normal urine varies widely in composition, being influenced by diet and other factors. The following represents the composition of *average* normal daily excretion of the constituents:

CONSTITUENTS	AMOUNT IN GRAMS
Water	1200
Solids	60
Urea	30
Uric acid	0.7
Hippuric acid	0.7
Creatinine	1.2
Indican	0.01
Oxalic acid	0.02
Allantoin	0.04
Amino acid nitrogen	0.2
Purine bases	0.01
Phenols	0.2
Chloride as NaCl	12.0
Sodium	4.0
Potassium	2.0
Calcium	0.2
Magnesium	0.15
Sulfur-total as S	1.0
Inorganic sulfates as S	0.8
Neutral sulfur as S	0.12
Conjugated sulfates as S	0.08
Phosphate as P	1.1
Ammonia	0.7

*From Hawk, Oser, and Summerson: Physiological Chemistry, ed. 12. Philadelphia, 1947, The Blakiston Company.

Table 117

List of a Few Foods and the Possible Allergens They Contain*

Baby Foods

Borden's Malted Milk: Barley, malt, wheat flour, whole milk
Carnick's Soluble Food: Malted wheat, dried milk, milk sugar
Dryco: Rice ''polish,'' vitamin B, irradiated milk
Farina: Wheat
Horlick's Malted Milk: Barley, wheat flour, desiccated milk, malt, Karo syrup (corn syrup)
Mellins' Food: Wheat flour, wheat bran, malted barley
Moore's Food: Wheat, malt
Nestle's Food: Malted whole wheat, malt, dry milk, wheat flour, cod-liver oil
Pablum: Wheat meal, oatmeal, corn meal, yeast, beef bone, iron, salt
Similac: Butter fat, olive oil, cocoanut oil, cod-liver oil

Beverages (Nonalcoholic)

Coca Cola: Caffein, caramel, essential oils (cinnamon, coriander, lemon, neroli, nutmeg, sweet orange) glycerin, lime juice, phosphoric acid, cocoa leaves or kola nuts
Ginger Ale: Ginger, lemon, sometimes capsicum
Root Beer: Caramel, oils of anise, birch, cassia, cloves, lemon, sassafras, wintergreen, coumarin, and vanilla
Sarsaparilla: Caramel, cologne spirits, oils of anise, orange, sassafras, wintergreen, powdered pumice stone

Beverages (Alcoholic)

Beer (Ale, Stout, Porter): Fermented malted grain, usually barley; wheat, rye, oats, rice, and corn may be used. Hops are usually added
Brandy: Grapes, peaches, cherries, apples, and othe fruits
Gin: Barley, malt, rye and corn; flavored with juniper berries, angelica root, calamus, cardamon, cassia, cinnamon, coriander, fennel, grains of paradise, licorice, orris root
Whiskey: Malt, corn, rye, and other cereals
Wines: Usually grapes; other fruits

Breads

Glazed crusts contain white of egg
Buckwheat flour is used on the bottom of all breads to prevent burning
Buckwheat Bread: Buckwheat, wheat, yeast
Kommisbrot: Rye
Pumpernickel: Rye graham flour (20 per cent), bleached clear flour (80 per cent), malt (0.1 per cent)
Rye Bread: Rye flour (25 per cent), bleached clear flour (75 per cent) yeast
Schwarzbrot: Coarse rye flour
White Bread: Bleached patent flour, yeast, malt, eggs, vegetable oil, butter
Whole Wheat Bread: Bleached patent flour, whole wheat flour, eggs, caramel
Corn Flakes: Corn, malt
Cream of Wheat: Entirely wheat
Farina: Wheat

*Alexander, Harry L.: Synopsis of Allergy, St. Louis, 1941, The C. V. Mosby Company.

Grape Nuts: Wheat, malted barley, yeast
Macaroni: Wheat, milk
New Pettijohn's: Wheat
Nutro: Wheat, peanut flour
Post Toasties: Corn
Postum Cereal: Wheat, bran, molasses
Post's Bran: Wheat, bran, malt, syrup
Quaker Crackles: Corn, wheat, oats
Ralston's Health Breakfast Food: Wheat
Roman Meal: Flaxseed
Spaghetti: Wheat and milk

Prepared Flours

Aunt Jemima's Pancake Flour: Wheat, corn, rice, rye, milk
Aunt Jemima's Buckwheat Flour: Corn, wheat, buckwheat
H.O. Co. Buckwheat Pancake Flour: Cornmeal, buckwheat, wheat
Purina Health Pancake Flour: Wheat, corn
Uncle Jerry's New England Corn and Rice Pancake Flour: Corn, wheat, potato, rice, leavening
Uncle Jerry's New England Self-Raising Buckwheat Flour: Buckwheat, wheat, corn, leavening

Desserts

Blanc Mange: Irish moss, milk, flavoring
Custard: Egg, milk, flavoring
Fritters: Flour, egg, milk
Gelatin: Cow, sheep, goat, pig and fish hides and connective tissue
Ice Cream: Egg, milk, flavoring
Ices: Fruit, egg, flavoring
Meringue: Egg, lemon

Pantry Supplies

Beef Juices: Meat, egg
Canned Tomato Soup: Tomato, butter, onion, wheat, spices
Catsup: Tomato, spices, onion
Cottolene: Cottonseed oil, beef suet
Crisco: Cottonseed oil
Noodles: Wheat, egg
Potato Chips: Potato, cottonseed oil

TABLE 118

The following edible foods are arranged in accordance with their botanical classification, in such a way that one may readily recognize those which are botanically related and which might cross-react.*

(1) *Seaweeds*
- Agar agar
- Irish moss

(2) *Fungi*
- Mushrooms
- Truffle
- Puff balls
- Molds
- Yeast

(3) *Gymnosperms*
- Pine nut

(4) *Cereal Grains*
- Wheat
- Rye
- Barley
- Malt
- Oat
- Rice
- Wild rice
- Corn

The cereal grains and potato provide the chief source of starchy food. Occasionally nearly all of the cereal grains must be avoided. In this case the following sources of starchy foods, not closely related to other foods may be drawn upon:

Arrowroot Cassava Tapioca
Sago (Florida Arrowroot or Indian Bread Root)

(5) *The Palm Family*
- Coconut
- Date
- Jujube

(6) *Pineapple.* This fruit is not closely related to any other food.
(7) *Banana.* This also has no closely related food.

(8) *The Lily Family*
- Onion
- Garlic
- Chive
- Leek
- Shallot
- Asparagus

(9) *The Mulberry Family*
- Mulberry
- Hop
- Fig
- Breadfruit

(10) *The Buckwheat Family*
- Rhubarb
- Buckwheat

(11) *The Walnut Family*
- Walnut
- Pecan
- Hickory

(12) *The Beech Family*
- Chestnut
- Filbert
- Beechnut

(13) *The Beet Family*
- Swiss Chard
- Beet
- Spinach

(14) *The Gooseberry Family*
- Currant
- Gooseberry

(15) *The Cabbage or Mustard Family*
- Turnip
- Rutabaga
- Cabbage
- Kale
- Collard
- Cauliflower
- Broccoli
- Brussels Sprouts
- Kohlrabi
- Mustard
- Radish
- Horseradish
- Water cress

(16) *The Rose Family*
- Strawberry
- Raspberry
- Blackberry
- Dewberry
- Logenberry

(17) *The Apple Family*
- Apple
- Apple Butter
- Crab Apple
- Quince
- Pear

Apple pectin is widely used in commercial jellies such as mint jelly and in some candy such as Turkish paste and gum drops

*Vaughn, Warren T.: Primer of Allergy, St. Louis, 1939, The C. V. Mosby Company.

(18) *The Plum Family*
- Peach
- Nectarine
- Apricot
- Almond
- Plum
- Prune
- Cherry

(20) *The Flax Family*
- Flaxseed (Linseed)

(22) *The Pistachio Family*
- Pistachio nut

(23) *The Grape family*
- Grape
- Raisin
- Currant (dried)
- Wine
- Brandy
- Grape Vinegar
- Grapejuice

(25) *The Chocolate Family*
- Chocolate
- Cocoa
- Cocoa butter

(28) *The Laurel Family*
- Cinnamon
- Avocado or alligator pear
- Bay leaves

(29) *The Huckleberry Family*
- Hucklebery
- Blueberry
- Cranberry

(30) *The Olive Family*
- Olive

(31) *The Morning Glory Family*
- Yam
- Sweet Potato

(33) *The Potato Family*
- Irish potato
- Tomato
- Red and green peppers
- Eggplant

(36) *The Thistle Family*
- Lettuce
- Salsify (oyster plant)
- Endive
- Chicory
- Jerusalem artichoke
- Artichoke
- Dandelion

(19) *The Legumes*
- Lentil
- Kidney bean
- Lima bean
- String bean
- Blackeye pea
- Soybean
- Pea
- Peanut
- Peanut butter

(21) *The Citrus Family*
- Citron
- Orange
- Tangerine
- Bergamot
- Lemon
- Grapefruit
- Lime
- Limequat
- Kumquat

(24) *The Mallow Family*
- Cottonseed
- Okra (gumbo)

(26) *The Tea Family*
- Tea

(27) *The Carrot Family*
- Carrot
- Pasnip
- Parsley
- Celery
- Celeriac
- Fennel
- Caraway seed
- Coriander
- Anise seed
- Dill

(32) *The Mint Family*
- Mint
- Sage
- Savory

(34) *The Coffee Family*
- Coffee

(35) *The Gourd Family*
- Squash
- Pumpkin
- Cucumber
- Cucumber pickle
- Watermelon
- Cantaloupe
- Muskmelon

TABLE 119

Recipes for Use in Allergy

(1) Chicken Croquettes

1 tbs. oil or chicken fat	½ c. liquid (chicken broth)
2 tbs. cornstarch	¾ c. cooked minced chicken
salt	

Make a sauce of fat, cornstarch, and liquid. Add the other ingredients. (Cooked corn meal may be added.) Cool. Shape and dip in rye flour or crushed corn flakes. Bake in medium oven or fry in deep fat.

(2) Corn Pone*

1 c. corn meal	boiling water
½ tsp. salt	1 tbs. Mazola oil

Carefully pour enough boiling water onto the corn meal to make a stiff mixture, stirring constantly. Add the oil and mix well. Mold into oblong "pones" and fry in hot skillet with enough fat to prevent sticking. When brown on one side, turn and brown on the other side. Serve hot.

(3) Corn and Rice Muffins*

⅓ c. rice flour	2½ tsp. baking powder
½ c. yellow corn meal	3 tbs. Mazola oil
2 tbs. sugar	½ c. water

Mix all the dry ingredients well, sifting them together four or five times. Add the water and oil. Bake in a hot oven for 20 minutes. Makes 6 small muffins.

(4) Corn and Rye Muffins*

Use recipe for Corn and Rice Muffins, but substitute rye flour for rice flour.

(5) Rice Biscuits

Made by the Battle Creek Sanitarium, Battle Creek, Mich.

(6) Rice Bread*

1 c. rice flour	1 tbs. sugar
3 tsp. baking powder	½ tsp. salt
2 tbs. bacon fat or oil	¾ c. water

Sift the dry ingredients. Add water and fat. Bake in a loaf pan in a moderate oven.

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*Fat used in recipes for greasing pans or shortening must be only oil or fat specified in the prescribed diet. Baking powder should be Royal or Schilling, which contain no egg.

(7) Rye-Rice Bread*

⅓ c. rye flour
⅔ c. rice flour
½ tsp. salt
6 tsp. sugar
5 tsp. baking powder
2 tsp. olive oil
1⅓ c. water

Sift all the dry ingredients together. Add water and oil. Bake in a loaf pan in a moderate oven for 40 minutes.

(8) Ry-Krisp

Prepared by the Ralston Purina Company, St. Louis, Mo.

(9) Pear Butter

Select firm, ripe pears. Peel, core, and cut into rather small pieces. To 2 c. of prepared fruit, add 1 c. sugar. Cook slowly, stirring frequently to prevent burning, for 2 hours or until the mixture is quite thick.

(10) Rice-Fruit Pudding Sauce

1 c. sugar
2 tbs. rice flour
1¼ c. boiling water
1 tsp. lemon juice or vanilla
½ tsp. salt

Mix sugar, salt, and cornstarch. Add water and cook until thick. Remove from stove and add flavoring. Add boiled rice and apricots or sliced peaches and serve warm. Reserve some sauce to pour over the pudding.

(11) Tapioca-Fruit Pudding

2 halves peaches sliced
1 tbs. dry tapioca
2 tsp. sugar
½ c. peach juice and water

Drain peaches and sprinkle with 1 tsp. sugar. Cook tapioca in juice and water until it is clear. Add remaining sugar and salt. Line a baking dish with peaches. Fill with tapioca and bake in a moderate oven for 20 minutes.

(12) Rice Cup Cakes*

⅔ c. hot water
1½ c. rice flour
2 level tbs. shortening
¼ c. sugar
¼ tsp. salt
3 level tsp. baking powder
1 tsp. vanilla

Pour hot water over half the flour. Cream sugar and shortening and add to the above mixture, beating well. Add the other ingredients, mixing well. Bake in muffin pans for about 20 minutes in a fairly hot oven.

(13) Lamb Patties

Ground lamb pressed into small patties. Broiled or fried.

*See statement as to fats under Corn Pone.

(14) Puffed Rice Candy

1 c. sugar
⅓ c. brown sugar
1 c. water
¼ tsp. salt
1 tsp. vanilla
Puffed rice

Cook sugar, syrup, and water until brittle. Add vanilla and salt. Pour puffed rice, stirring all the time so that the kernels will be evenly coated. Turn it into a greased pan and cut in squares. Keeps well in an airtight container.

(15) Tomatoes Cooked With Sugar

Select firm, ripe tomatoes. Remove the skins, cut in slices, and drain an hour or more. For each cup of tomatoes add a cup of sugar and boil until thick, stirring often. Sliced lemon may be added to the tomatoes while cooking.

(16) Chicken and Pineapple Salad

Cut cold boiled chicken into cubes and marinate for 2 hours in French dressing of oil and white vinegar and salt. Drain well, mix chicken with about one-third its volume of diced pineapple, and add special mayonnaise, thinned with pineapple juice to taste.

(17) Split Pea Soup

1 c. split peas
1 tbs. bacon fat
diced bacon (crisp)
salt

Cook the peas until they form a smooth purée. Just before serving, add salt, bacon fat, and crispy fried bacon.

(18) Rye or Rice Cookies

1 c. rye or rice flour
⅓ c. light molasses (or syrup)
3 tbs. Wesson oil
¼ tsp. salt
⅓ tsp. soda
1½ tsp. baking powder
1 tbs. sugar
Water to make a stiff dough

Mix dry ingredients. Add syrup, oil, and water. Drop on a greased cookie sheet and bake at 325° F. for 15 minutes.

(19) Fruit Cornstarch Pudding

1½ c. fruit pulp
1½ c. water
2 tsp. sugar
5 level tsp cornstarch

Cook for ½ hour in the top part of a double boiler.

(20) Tapioca With Apricots

6 halves apricots, puréed
2 tsp. sugar
1 tbs. dry tapioca
½ c. juice and water

Cook the liquid and tapioca in a double boiler until tapioca is clear. Add apricots and blend well. Serve warm with apricot juice.

(21) Lima Bean-Potato Muffins or Bread*

⅔ c. potato flour	½ tsp. salt
½ c. Lima bean flour	4 tsp. sugar
3 tsp. baking powder	½ c. water
2 tbs. shortening	

Sift dry ingredients together. Melt fat and add to water; add slowly to dry ingredients. Put in greased muffin tins and bake at 400° F. for 20 minutes. Serve hot. Makes 10 small muffins.

(22) Lima Bean-Soya Bean Bread

Substitute soya bean flour for potato flour in recipe for potato-Lima bean bread.

(23) Boiled Mayonnaise

1 tsp. sugar	juice of 1 large lemon
½ tsp. salt	⅞ c. boiling water
3 level tsp. starch†	½ c. Mazola oil

Mix sugar, salt, starch, and lemon juice. Add water; cook until thick. Remove from stove and slowly add oil, beating vigorously.

(24) Purée of Lima Bean Soup

Wash and soak, for a few hours, 2 c. Lima beans. Cook in plenty of water salted to taste. When beans are well done, put through a sieve.

Cook small pieces of bacon, crisp. Add enough bacon dripping and crisp fried bacon to purée to make palatable.

(25) Lima Bean-Potato Cake or Cookies*

6 tbs. Lima bean flour	2½ tsp. baking powder
¾ c. potato flour	½ tsp. vanilla
5 tbs. shortening	½ tsp. lemon extract
½ c. water	few grains salt
⅔ c. sugar	few drops yellow coloring

Sift dry ingredients; cream fat and sugar; add dry ingredients and water alternately to creamed mixture. Add flavorings and coloring. Put in greased muffin tins and bake in oven at 430° F. for 30 minutes.

(26) Penoche Frosting

3 c. brown sugar	¾ c. water

Boil sugar and water until soft ball is formed when tested in cold water. Remove from heat, cool, and beat until creamy. An extra tablespoonful of

*See footnote * page 571.

†Use rice flour in Diet 1, cornstarch in Diet 2, and potato flour in Diet 3.

water may be added if necessary for easy spreading. White sugar may be used instead of brown, and vanilla or lemon flavoring may be added. Chopped fruit may also be added if desired.

(27) **Carrot Marmalade**

5 very large carrots	sugar
4 lemons	10 c. water

Squeeze juice and add later. Remove all seeds. Then grind lemons and carrots together. Add water. Boil all this together for a good half hour; then measure it cup for cup of pulp and sugar. Boil slowly for an hour, or until it jells. Lemons vary slightly in congealing time.

TABLE 120

Food Habits of Different Peoples*

French Canadian

Milk	Little milk is used.
Cream	Cream is usually sold.
Cheese	Cheese is seldom used.
Butter	Some butter is used; lard is used extensively for frying.
Cereals	Oatmeal is the cereal most used.
Breads	White bread, made with water, and corn bread are favorite breadstuffs.
Vegetables and Fruits	Cabbage, turnip, beets, and peas are principal vegetables. These are often cooked too long a time in soups. Salt beans are used in winter. Apples and green tomatoes (in pickle) are used a great deal.
Meat, Egg, and Meat Substitutes	Salt fish is used a great deal. Pork is used often; beef, seldom.
Sweets and Desserts	Pastry and cake are used much too frequently.

Irish

Milk	Buttermilk is used with potatoes and cereal a great deal.
Cream	No cream is used.
Butter	Butter is used a little on bread; lard drippings are used instead of butter for cooking.
Cheese	Little cheese is used.
Cereals	Oatmeal is cereal most frequently used. Indian meal porridge is used too.
Breads	White baker's bread is most commonly used.
Starches	Rye, oaten cake, and whole wheat bread are occasionally made at home.
Vegetables and Fruits	Potatoes, turnip, and cabbage are the vegetables most used. Lettuce and tomatoes are being used more frequently now. Potatoes are eaten with salt or milk; other vegetables are usually cooked together in soup. Little fresh fruit is used. Some stewed fruit and sauces are used for dessert.
Meat, Egg, and Meat Substitutes	Eggs are usually served plain boiled. Bacon is used quite generally; mutton, occasionally; beef, almost never. Fish—cod, haddock, herring are used a good deal.

*From Charlotte Raymond: *Food Customs From Abroad.* Reproduced from a reprint issued by the Massachusetts Department of Public Health.

Sweets and Desserts	Cake and pie are used frequently for dessert. Tea is used with much sugar three times a day. Sugar is added freely to prepared foods.

Italians

Milk	Are learning to use more milk for children to drink, but not enough is used.
Cream	No cream is used except in fancy desserts.
Cheese	Do not like American cheese and, as imported cheese is expensive, they do not use it as freely as when living in Italy.
Butter	Will give butter to children.
Cereals Breads Starches	Cornmeal, polenta, is used as a main dish in the Northern part of Italy. Do not care much for cereals such as oatmeal, wheatena. Use farina. Macaroni and spaghetti are used in many shapes and forms. Use quantities with various sauces and cheese. Some whole grain is now available. White bread is very crusty. Are using more Italian whole wheat bread than formerly.
Vegetables and Fruits	Decreased use of green vegetables is due to expense and the fact that quantities must be consumed to satisfy. Use potatoes occasionally—fried. Do not like to use canned goods except tomato paste. Vegetables are cooked too much as a rule. Eggplant is a favorite. Variety of salads is used if they can afford it.
Meat, Egg, and Meat Substitutes	Very often meat is used in small amounts for flavor. Because of its greater availability it is used more extensively here than in Italy, to the exclusion of vegetables. Highly seasoned meats, such as veal loaf, salami, sausage, and bologna, are favorites. Fish is used some, especially by families of fishermen. They also used squid, octopus, and snails. Many varieties of dried beans are used in soups and main dishes. Eggs are fried—plain or with peppers, spinach, etc.
Sweets and Desserts	Very few desserts are used although they make cake occasionally. Do not like milk puddings, but acquire a taste for sweets and candy here in the United States. Marzipan and fancy cakes are used on special occasions. Chestnuts are used. Often use fruit for dessert. Spumone, a rich ice cream, is used for festivals.
Miscellaneous	Olive oil is used in quantities for frying and in cooking. Salt pork is used in cooking. Garlic and peppers are used for flavoring.

Jewish

Milk Cream Cheese Butter	Use milk plentifully if they can afford it. Use sour cream if able to buy it. Cream cheese and cottage cheese are used. Sweet butter is preferred.
Cereals Breads Starches	Oatmeal and farina are used as breakfast food. Barley and buckwheat (kasha) are used in soups. Noodles and other egg and flour mixtures, rye bread and white rolls are used. Matzoth is unleavened bread eaten at the Passover.
Vegetables and Fruits	Root vegetables are used with meats and in soups (borsch). Raw vegetables (lettuce, cucumbers, tomatoes) are used frequently. Potatoes are used with meat. Dried fruits, oranges, apples, pears, grapes, plums are used if they are able to afford them. Often used as compotes. Pickled and salted cucumbers and relishes are used.
Meat, Egg, and Meat Substitutes	Meat and poultry are chosen, killed, and prepared according to religious law (Kosher). Cheaper cuts are used (hind quarter is not used). Meat is boiled or cooked with vegetables. Cannot use meat and dairy products at the same meal. Use meat soups. Use chicken, especially on Sabbath eve (Friday). Use internal organs. Fresh-water fish, cod, haddock, smoked and salt fish, and salmon are used. Dried peas and beans and lentils are used, especially in soups. Eggs, plain, to eat; in soups, noodles.
Sweets and Desserts	Rich pastry is rolled with nuts and fruits (streudel). Dried fruits. Cheese cake. Sponge cakes and macaroons at Passover.
Miscellaneous	Chicken fat, vegetable oil, Crisco. Highly seasoned food. Many relishes, as horseradish.

Near East

Armenia *Syria* *Turkey* *Greece*

Milk Cream Cheese Butter	Do not use enough milk, except for invalids. Are suspicious of bottled milk. Pasteurized milk does not make such good clabbered milk (matzoon or yourt) which dish they use in their own country. Clotted cream is used. Sour milk and hard cheese are used some. Little butter is used. (Will give both milk and butter to children when urged.)

Cereals Breads Starches	Cracked wheat and rice are used with meat and vegetables, or with nuts and with fruits for desserts. Will give children cereal for breakfast. White bread of refined flour is baked on griddles same as in old country. Dark breads are used.
Vegetables and Fruits	Plenty of vegetables are used if money permits. These are fried in oil or broiled on a spit, stuffed with wheat or rice, put with meat, nuts, beans, and then cooked in lamb broth (peppers, tomatoes, cabbage and grape leaves, cucumbers, squash). Few potatoes are used. Few fruits, except dried apricots and raisins, are used.
Meat, Egg, and Meat Substitutes	Lamb (kebak or kibab) is the only meat used to any extent. It is cooked on skewers or with wheat or rice. Sometimes it is ground and eaten raw with cracked wheat. No roasts are used. It is combined with cracked wheat or rice, served instead of potato, and stuffed in vegetables. Nuts are used in place of meat with cracked wheat and rice. Dried peas, beans, lentils are used somewhat.
Sweets and Desserts	Both honey and sugar are used for sweetening. Use few desserts. Fruits compotes are used. Paklava (pastry, shortened with lamb fat, rich with nuts and honey). Boiled whole wheat grains or, in this country, shredded wheat with nuts and honey (boulgour). Bread and honey with cream can be bought at restaurants and bakeries. Apricot candy, Turkish paste.
Miscellaneous	Lamb fat and olive oil are used a great deal. Ripe olives are used in place of butter. Many and varied spices are used in combination. Turkish coffee (thick, sweetened coffee).

Polish

Milk Cream Cheese Butter	Milk and sour cream are used extensively in own country, but somewhat less widely used in the United States for economic reasons. Milk and sour cream are used in soup. Butter is used moderately on bread; little is used in cooking.
Cereals Breads Starches	Cereals are not used in Poland. Oatmeal and corn flakes are preferred in this country. Dark, rye bread is served at each meal. (White bread is preferred by school children.)
Vegetables and Fruits	Vegetables used are chiefly cabbage and root vegetables cooked for a long time. Vegetables are served principally in soup or boiled and served with hot milk. Fruits are limited for economic reasons.

Meat, Egg, and Meat Substitutes	Beef, pork, and veal are the meats used most frequently, usually cooked with vegetables or in soup. Eggs are used frequently, fried or boiled. Fish is used only on Fridays.
Sweets and Desserts	Limited use of pastry except on special holidays. Few desserts are prepared. Much candy is given to children. Much white sugar is used in and on foods.

Portuguese

Cheese Cream Butter Milk	Milk and butter are used very little. Cheese is used extensively in native land on bread. Lard is used extensively by the Azorians.
Cereals Breads Starches	Cereals are omitted except for corn products. Breads used are made principally from white flour and corn meal in this country.
Vegetables and Fruits	Plenty of greens are used such as kale, cabbage, and beans. They are, however, served in soups after too long cooking. Fruit is used freely in native land. Little fruit is used in this country due to economic reasons.
Meat, Egg, and Meat Substitutes	Meat is seldom used and usually as a flavor. Fish is much used. Sausage is used often, as in soup. Meats used are beef, pork sausage, and some veal. Eggs are used moderately.
Sweets and Desserts	The use of sweets is very limited. Little attention is paid to prepared desserts and rich pastry.

Table 121

Symbols and Abbreviations

Ad lib.—as desired *(ad libitum)*
Avoir.—avoirdupois
B. i. d.—twice daily
bl., bbl.—barrel
BHNHE—Bureau Human Nutrition and Home Economics
B.M.—basal metabolism or bowel movement
B.M.R.—basal metabolic rate
B.P.—boiling point
bu.—bushel
C—carbon
C.—centigrade, carbohydrate
c.—cup
Ca—calcium
cal.—calorie
cap.—capsule
c.c.—cubic centimeter; also occasionally written cu.cm.
cent.—centigrade (centum meaning 100)
cg., cgm.—centigram
Cl—chlorine, chlorin
cm.—centimeter
C.P.—chemically pure
cryst.—crystallized, crystalline
Cu—copper
cu.—cubic
D—500
decoct.—decoction
deg.—degree, degeneration
deglut.—deglutition (swallowing)
det.—to be given (detur)
dil.—dilute
dim.—one-half *(dimidius)*
dr.—dram
dsp.—dessert spoon
ea.—each
e.g.—for example
et al.—and others *(et alibi)*
et seq.—and the following
F—fluorine, fluorin
F.—Fahrenheit, fat
Fahr.—Fahrenheit
Fe—iron
filt.—filter
fl. dr.—fluid dram
fl. oz.—fluid ounce
gal.—gallon
γ—gamma
gi.—gill
gm.—gram
gr.—grain
gtt.—drop *(guttae)*
H—hydrogen
Hb.—hemoglobin
hr.—hour
ht.—height
I—iodine, iodin
i. d.—daily *(in die)*
ibid.—in the same place *(ibidem)*
id.—the same *(idem)*
in.—inch
I. U.—International unit
kg., kgm., kilo—kilogram
kl.—kiloliter
km.—kilometer
L.—liter
lb.—pound *(libra)*
liq.—liquor
M—1000
Mg—magnesium
mg.—milligram
μg, mcg.—microgram
min.—minim
ml.—milliliter or c.c.
mm.—millimeter
Mn—manganese
N—nitrogen
Na—sodium *(natrium)*
Ni—nickel
No.—number
noct.—at night *(nocte)*
O—oxygen
o.m.—every morning *(omni mane)*
ol.—oil *(oleum)*
os.—mouth *(ostium)*
oz.—ounce
P—phosphorus
P.—protein
p.c.—after a meal *(post cibum)*
pH—index of acidity or alkalinity
pil.—pill
pk.—peck
pond.—by weight *(pondere)*
ppt.—precipitate
p.r.n.—when required *(pro re nata)*
pt.—pint
pulv.—powder *(pulvis)*
q.d.—four times daily *(quater in die)*
q.h.—every hour *(quaque hora)*
q.l.—as much as one pleases *(quantum libet)*
qt.—quart
R.Q.—respiratory quotient
℞—recipe, prescription
S—sulphur (sulfur)
sat.—saturated
S.D.A.—specific dynamic action
sig.—let it be labeled *(signetur)*
sol.—solution
solv.—dissolve (solve)

Table 121—Cont'd

sp. gr.—specific gravity
spk.—speck
sq.—square
ssp.—salt spoon
stat.—immediately *(statim)*
sym.—symmetric
syr.—syrup (sirup)
T.—temperature
tab.—tablet
T. (written with a capital to differentiate from a small t.)
tb.
tbs. tablespoon
tbsp.
t.i.d.—three times daily *(ter in die)*
tinct.—tincture
t. (written as small t. to differentiate from T.)
ts. teaspoon
tsp.
u.—unit
ur.—urine
U.S.D.A.—United States Department of Agriculture
U.S.P.—United States Pharmacopoeia
v.—volume
vehic.—vehicle
w.g.—water glass
wt.—weight
Zn—zinc
$<$—less than
$>$—more than

Table 122

Table of Weights and Measures and Conversion Values

1 c.c. = approximately 1 gm. or 16 minims. 1 min. = 0.06 c.c.

A minim and a drop (gtt.) are usually considered to be of equal size. However, the size of the drop is dependent on the bore of the dropper. One cubic centimeter, therefore, may contain from 12 to 20 drops or even 50 as in the dropper accompanying A-D vitamin concentrates.

Whether the cubic centimeter and gram are equivalent will depend upon the specific gravity (sp. gr.) of the liquid.

1 standard tsp. = 5 c.c.

Unfortunately, the old value of 4 c.c. continues to be used in many medical and pharmaceutical texts. Teaspoons today contain 5 c.c., and not 4 c.c., as they did many years ago. A 4 c.c. teaspoon can be found in silver sets of two generations ago or currently as a "five o'clock teaspoon." It is not a spoon in general use. This old teaspoon is equivalent to 1 fl. dr.

1 dsp. = 2 tsp.
1 tbs. = ½ fl. oz. = 4 drams = 15 c.c.
1 c. = 16 tbs. = 8 fl. oz. = 237 c.c. (approx. 240 c.c.) = 2 gills = ½ pint
2 c. = 1 pt.
2 pt. = 1 qt.
1 qt. = 0.946 L.
1 L. = 1.056 qt. or 1,000 c.c.
4 qt. = 1 gal.
8 qt. = 1 pk.
4 pk. = 1 bu.
1 dr. = ⅛ fl. oz., 3.696 c.c. (approx. 4 c.c.)
7.29 dr. = 1 oz.
1 fl. oz. = 29.574 c.c. (approx. 30 c.c. or 2 tbs.)
1 gr. = 0.065 gm.
1 gm. = 15 gr.
1 oz. = 28.35 gm. (approx. 30 gm.)
1 lb. = 453.6 gm. (approx. 450 gm.)
1 kilo = 2.2 lb.
1 lb. = 0.454 kilo

14 lb. = 1 stone
1 stone = 6.35 kilo.
10 mg. = 1 cg.
100 cg. = 1 gm. (A Buffalo nickel weighs 5 gm.)
1,000 g. = 1 kg. or kilo
2.5 cm. = 1 in.
40 in. = 1 meter
Average wine glass = 2 oz. as served.
Average teacup = 4 oz. as served.
Average coffee cup = 6 oz. as served.
Average water glass = 200 c.c. as served.
Standard measuring cup = 8 oz. or 240 c.c.

*Conversion Table**

gr. × 0.065 = gm.
gm. ÷ 15 = gr.
in. × 2.5 = cm.
cm. ÷ 2.5 = in.
oz. × 30 = gm.
gm. ÷ 30 = oz.
lbs. × 2.2 = kilo
kilo ÷ 2.2 = lbs.
Freezing 0° C. or 32° F.
Body temperature 37° C. or 98.6° F.
Boiling 100° C. or 212° F.
Fahrenheit to Centigrade—subtract 32 from 212 so that freezing points correspond, then 180° F. = 100° C., or 1° F. = $\frac{100}{180}$ or 5/9° or 0.55 C., therefore the F. figure − 32 × 5/9 or 0.55 = C.; the C. value × 9/5 or 1.8 + 32° = F.

Example: (98.6° F. − 32) 5/9 = 37° C.

*For exact conversion values see exact figure given above.

TABLE

UNITED STATES DEPARTMENT

Agricultural Research
Bureau of Human Nutrition

NEWLY REVISED FAMILY FOOD PLANS

On the accompanying sheets, the Bureau of Human Nutrition and Home Economic has brought two of its family food plans into line with recommended dietary allowance as revided in 1948 by the National Research Council. The new plans replace September 1947, plans.

The revised recommended dietary allowances call, notably, for more calcium an fewer calories in daily food or some adult groups. Applying the new recommendation to market lists and meal plans, the bureau has increased the milk for certain groups

FAMILY FOOD PLA

Weekly Quantities of Food for Each Membe

FAMILY MEMBERS	LEAFY, GREEN YELLOW VEGETABLES LB. — OZ.	CITRUS FRUIT, TOMATOES LB. — OZ.	POTATOES, SWEET POTATOES LB. — OZ.	OTHER VEGETABLES AND FRUIT LB. — OZ.
Children under 12:				
9-12 months	1 — 8	1 — 12	0 — 8	1 — 0
1-3 years	1 — 12	1 — 12	1 — 0	1 — 0
4-6 years	1 — 12	1 — 12	1 — 8	1 — 4
7-9 years	2 — 0	2 — 0	2 — 8	1 — 8
10-12 years	2 — 4	2 — 4	3 — 0	1 — 12
Girls:				
13-15 years	2 — 4	2 — 4	3 — 4	1 — 12
16-20 years	2 — 4	2 — 4	3 — 0	1 — 12
Boys:				
13-15 years	2 — 8	2 — 8	4 — 0	2 — 4
16-20 years	2 — 12	2 — 8	5 — 0	2 — 8
Women:				
Sedentary	2 — 4	2 — 0	2 — 4	1 — 12
Moderately active	2 — 4	2 — 0	3 — 0	1 — 12
Very active	2 — 8	2 — 8	4 — 0	2 — 0
Pregnant	3 — 0	2 — 8	2 — 8	2 — 0
Nursing	3 — 8	3 — 12	4 — 0	2 — 4
60 years or over[5]	2 — 8	2 — 4	2 — 8	1 — 12
Men:				
Sedentary	2 — 4	2 — 0	3 — 0	1 — 12
Physically active	2 — 8	2 — 8	4 — 0	2 — 0
With heavy work	2 — 8	2 — 8	6 — 0	2 — 8
60 years or over[5]	2 — 8	2 — 4	3 — 4	1 — 12

[1]Or its equivalent in cheese, evaporated milk, or dry milk.

[2]Count 1½ pounds of bread as 1 pound of flour. Use as much as possible in the for of whole grain or restored products.

[3]For small children and pregnant and nursing women, cod liver oil or some oth source of vitamin D is also needed. For elderly persons and for persons who have opportunity for exposure to clear sunshine, a small amount of vitamin D is also des able.

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and made small changes in quantities of some other foods. Food allowances in the plans for the 9- to 12-month age group have also been adjusted to take into account current infant feeding practices.

The Bureau is incorporating these two new family food plans, and a third—at a still lower cost than Low Cost Plan A—in a new bulletin, *Helping Families Plan Food Budgets.* Family economists of the Bureau have written this bulletin for social welfare workers. MP 662 is expected off the press in a few weeks. It will be available on a sales basis from the Superintendent of Documents, Washington 25, D. C. The price is not yet set.

AT LOW COST (PLAN A)*

of Family (Prelim. for Misc. Pub. 662)

MILK[1] QT.	MEAT, POULTRY, FISH LB. OZ.	EGGS NO.	DRY BEANS AND PEAS, NUTS LB. OZ.	FLOUR, CEREALS[2] LB. OZ.	FATS AND OILS[3] LB. OZ.	SUGAR, SYRUPS, PRESERVES LB. OZ.
6	0 — 4	5	0 — 1	0 — 10	0 — 1	0 — 1
5½	[4] 0 — 8	5	0 — 1	1 — 4	0 — 2	0 — 2
5½	1 — 0	5	0 — 2	1 — 12	0 — 6	0 — 6
5½	1 — 8	5	0 — 4	2 — 4	0 — 8	0 — 10
6	1 — 12	5	0 — 4	3 — 4	0 — 12	0 — 12
6½	[4] 2 — 0	5	0 — 4	3 — 8	0 — 12	0 — 12
5	[4] 2 — 0	5	0 — 4	3 — 4	0 — 12	0 — 10
6½	2 — 0	5	0 — 8	4 — 8	1 — 0	0 — 14
6½	2 — 0	5	0 — 8	5 — 12	1 — 6	1 — 0
5	2 — 0	5	0 — 4	2 — 0	0 — 10	0 — 10
5	2 — 0	5	0 — 4	3 — 4	0 — 12	0 — 12
5	2 — 0	5	0 — 6	4 — 4	1 — 0	1 — 0
7½	[4] 2 — 4	7	0 — 4	2 — 12	0 — 8	0 — 8
10½	[4] 2 — 8	7	0 — 4	3 — 0	0 — 10	0 — 8
5	2 — 0	4	0 — 2	2 — 4	0 — 8	0 — 8
5	2 — 0	5	0 — 4	3 — 4	0 — 12	0 — 12
5	2 — 0	5	0 — 6	4 — 4	1 — 0	1 — 0
5	2 — 0	5	0 — 10	7 — 12	1 — 14	1 — 0
5	2 — 0	4	0 — 2	3 — 4	0 — 10	0 — 10

[4]To meet iron allowance, one large or two small servings of liver or other organ meats should be served each week.

[5]The nutritive content of the weekly food quantities for a man and woman 60 years or over were based on the National Research Council's recommended daily allowances for the sedentary man and woman.

*See plan B if food quantities at a lower cost level are desired. Bureau of Human Nutrition and Home Economics, U. S. Department of Agriculture.

FAMILY FOOD PLA

Weekly Quantities of Food for Each Membe

FAMILY MEMBERS	LEAFY, GREEN YELLOW VEGETABLES LB. — OZ.	CITRUS FRUIT, TOMATOES LB. — OZ.	POTATOES, SWEET POTATOES LB. — OZ.	OTHER VEGETABLES AND FRUIT LB. — OZ.
Children under 12:				
9-12 months	1 — 8	1 — 12	0 — 8	1 — 0
1-3 years	2 — 0	2 — 0	0 — 8	1 — 12
4-6 years	2 — 4	2 — 4	1 — 0	2 — 4
7-9 years	2 — 8	2 — 8	1 — 12	2 — 8
10-12 years	3 — 0	2 — 12	2 — 4	2 — 8
Girls:				
13-15 years	3 — 8	2 — 12	2 — 8	3 — 8
16-20 years	3 — 8	2 — 12	2 — 8	3 — 8
Boys:				
13-15 years	3 — 8	3 — 0	3 — 8	3 — 8
16-20 years	4 — 0	3 — 8	4 — 8	3 — 8
Women:				
Sedentary	3 — 4	2 — 8	1 — 12	3 — 4
Moderately active	3 — 8	2 — 8	2 — 8	3 — 8
Very active	3 — 12	3 — 0	3 — 4	4 — 0
Pregnant	4 — 0	3 — 8	2 — 4	3 — 0
Nursing	4 — 0	4 — 8	3 — 0	3 — 8
60 years or over[5]	3 — 8	2 — 12	2 — 0	3 — 0
Men:				
Sedentary	3 — 8	2 — 8	2 — 8	3 — 8
Physically active	3 — 12	3 — 0	3 — 4	4 — 0
With heavy work	4 — 0	3 — 8	5 — 0	4 — 4
60 years or over[5]	3 — 8	2 — 12	2 — 12	3 — 0

AT MODERATE COST

of Family (Prelim. for Misc. Pub. 662)

MILK[1]	MEAT POULTRY, FISH		EGGS	DRY BEANS AND PEAS NUTS		FLOUR, CEREALS[2]		FATS AND OILS[3]		SUGAR, SYRUPS, PRESERVES	
QT.	LB.	OZ.	NO.	LB.	OZ.	LB.	OZ.	LB.	OZ.	LB.	OZ.
6	0	4	5	0	1	0	10	0	1	0	1
6	[4]0	12	6	0	1	1	4	0	2	0	2
6	1	4	7	0	1	1	8	0	6	0	8
6½	1	12	7	0	2	2	0	0	8	0	12
7	2	4	7	0	2	2	12	0	12	0	14
7	[4]2	12	7	0	2	2	12	0	14	0	14
6	[4]2	12	7	0	2	2	8	0	12	0	14
7	3	0	7	0	4	4	0	1	2	1	2
7	3	4	7	0	6	5	4	1	6	1	4
5	2	8	7	0	1	1	12	0	10	0	12
5	2	12	7	0	2	2	8	0	14	0	14
5	3	0	7	0	4	3	12	1	2	1	2
7½	[4]3	0	7	0	2	2	4	0	10	0	10
10½	[4]3	0	7	0	2	2	8	0	12	0	12
5½	2	8	6	0	1	1	12	0	8	0	10
5	2	12	7	0	2	2	8	0	14	0	14
5	3	0	7	0	4	3	12	1	2	1	2
5	3	8	7	0	6	7	0	2	0	1	4
5½	2	12	6	0	2	2	8	0	12	0	12

[1]Or its equivalent in cheese, evaporated milk, or dry milk.

[2]Count 1½ pounds of bread as 1 pound of flour. Use as much as possible in the form of whole grain, enriched or restored products.

[3]For small children and pregnant and nursing women, cod liver oil or some other source of vitamin D is also needed. For elderly persons and for persons who have no opportunity for exposure to clear sunshine a small amount of vitamin D is also desirable.

[4]To meet iron allowance, one large or two small servings of liver or other organ meats should be served each week.

[5]The nutritive content of the weekly food quantities for a man or woman 60 years or over were based on National Research Council's recommended daily allowances for the sedentary man and woman.

Bureau of Human Nutrition and Home Economics, U. S. Department of Agriculture.

Table 124

Food Composition Table for Short Method of Dietary Analysis*

Eva G. Donelson and Jane M. Leichsenring
Division of Home Economics, University of Minnesota, St. Paul

The estimation of the nutritive value of a diet, following the usual procedure in which separate computations are made for each food item, assumes a greater degree of accuracy than is justified when the wide variation in composition of any given food is taken into consideration. In view of this, a short method of dietary analysis was developed in which foods of similar composition were grouped together and mean values for each of the nutrients established.

The accuracy of the values in this food composition table was tested on a series of 30 three-day diet records. These were computed first by the usual method whereby each individual food item is calculated separately, and then using the revised table. Comparison of the results secured by the two methods showed a high degree of accuracy for the values in the food composition table. When tested statistically the observed differences were shown to be due to errors in random sampling and not to real differences between the two methods.

FOOD	APPROXIMATE MEASURE	WT. GM.	CALORIES	PROT. GM.	FAT GM.	CARBOHYDRATE GM.	Ca GM.	P GM.	Fe MG.	VIT. A. I.U.	ASCORBIC ACID MG.	THIAMINE MG.	RIBOFLAVIN MG.	NIACIN MG.
Cereal products: refined	1 sl. bread (30 gm.); ½ c. cooked cereal and cereal products (20 gm. dry); 1 c. prep. cereal (30 gm.); 3 soda crackers (20 gm.); 1½ c. popcorn (20 gm.); 1 griddle cake		08	2.5	1	15	.01	.03	.2	—	—	.02	.02	.2
whole grain and enriched	1 sl. bread (30 gm.); ½ c. cooked cereal (20 gm. dry); 1 c. prep. cereal (30 gm.); 2 graham crackers (20 gm.)		80	2.5	1	15	.01	.04	.6	—	—	.06	.04	.6

*Reprinted from Journal of the American Dietetic Association 21: No. 7, July-August, 1945, by permission.

Dairy products: butter	1 tsp.	5	35	—	4	—	—	—	—	160	—	—	—	—
cheese, Cheddar type	1 cu. in.	30	120	7.0	10	1	.25	.18	.3	430	—	.01	.14	—
cheese, cottage, skim	½ c.	100	100	19.0	1	4	.08	.26	.2	70	—	.01	.13	—
cream, light	⅛ c.	30	60	1.0	6	1	.03	.02	.1	360	—	.01	.04	—
custard	½ c.	130	150	7.0	7	15	.13	.14	.9	435	—	.08	.26	.1
eggs	1 med.	50	80	6.5	6	—	.03	.10	1.4	495	—	.07	.18	—
ice cream, commercial	⅔ c.	80	165	3.0	10	16	.06	.05	.2	265	—	.02	.21	.1
milk, buttermilk, skim	1 c.	240	90	8.5	1	12	.29	.23	.7	25	2	.11	.43	.2
milk, whole	1 c.	240	160	8.5	9	12	.28	.22	.5	410	2	.10	.43	.3
Desserts: cake, plain, chocolate	1 piece cake 2½ × 2½ × 2½ in. (75 gm.), for iced add 1 serving sweets; 1 waffle 6 in. dia. (60 gm.)		225	4.0	11	28	.03	.06	.8	175	—	.09	.11	.6
cookies, plain	2 med. 3 in dia.; 1 brownie	40	150	2.0	7	20	.01	.03	.3	155	—	.04	.03	.2
pie crust	⅙ shell, single crust	25	105	1.5	6	11	—	.02	.4	—	—	.06	.04	.5
puddings, cream fillings	½ c.	140	210	4.5	6	35	.16	.13	.6	230	—	.06	.22	.1
Fats	2 sl. bacon (20 gm.); 1 tbsp. fat (12 gm.); 1 tbsp. mayonnaise (15 gm.); 1 cu. in. salt pork (15 gm.); 1½ tbsp. French dressing (15 gm.)		120	1.0	13	—	—	.01	.2	5	—	.01	.01	.2
Fish: cod, haddock, fresh, cooked	1 med. serving	75	50	12.5	—	—	.01	.14	1.5	—	—	.05	.06	.8
halibut, herring, tuna, whitefish, cooked	1 med. serving; tuna (60 gm.); others (75 gm.)		105	15.0	5	—	.02	.17	.8	35	—	.04	.08	2.4
salmon, canned	1 med. serving	75	125	15.5	7	—	.05	.22	.7	220	—	.02	.12	5.9

TABLE 124—CONT'D

FOOD	APPROXIMATE MEASURE	WT. GM.	CALORIES	PROT. GM.	FAT GM.	CARBOHYDRATE GM.	Ca GM.	P GM.	Fe MG.	VIT. A. I.U.	ASCORBIC ACID MG.	THIAMINE MG.	RIBOFLAVIN MG.	NIACIN MG.
Fruits: banana	1 small	100	95	1.0	—	23	.01	.03	.6	350	10	.04	.07	.6
cantaloupe	½ melon, 4 ½ in. dia.	150	35	1.0	—	8	.02	.02	.6	3,600	52	.08	.08	.1
citrus	1 med. orange; ½ med. grapefruit; ½ c. juice; 1 med. large lemon	100	50	1.0	—	11	.02	.02	.4	180	42	.07	.03	.2
yellow, fresh, canned, dried	fresh (100 gm.); 1 med. peach, 2 to 3 apricots, 3 plums; dried (30 gm.), add ½ serving sweets; for sweetened canned, dried or fresh, add 1 serving sweets		55	.5	—	13	.01	.02	.4	585	4	.01	.02	.6
other, dried	3 to 4 dates; 1½ to 2 small figs; dried apple; ¼ c. raisins	30	90	.5	—	22	.02	.03	.9	30	1	.04	.03	.2
other, fresh and canned	½ c. cooked; sweetened, add 1 serving sweets	100	65	.5	—	15	.01	.01	.4	80	6	.02	.02	.1
Gravy; white sauce	¼ c.	60	70	2.5	5	4	.05	.05	.2	180	—	.04	.1	.1
Legumes: beans, peas,	½ c. cooked; dried (30 gm.)		105	6.5	—	19	.03	.12	2.4	20	—	.14	.06	.5
soybeans	½ c. cooked; dried (30 gm.)		105	10.5	5	4	.07	.18	2.5	55	—	.24	.10	.8
Meat: beef, fowl, lamb, veal, cooked	1 med. serving	75	160	18.0	10	—	.01	.18	3.1	20	—	.09	.15	3.9
liver, cooked	1 small serving	60	80	12.0	2	4	.01	.22	4.9	16,500	9	.12	1.22	.60
luncheon meats, cooked	2 sl. sausage, minced ham, dried beef, luncheon roll (30 gm.); ½ frankfurter (30 gm.)		80	5.0	6	1	—	.06	.7	—	—	.09	.07	.8
pork; ham, cooked	1 med. serving	75	205	18.0	15	—	.01	.18	2.4	—	—	.60	.15	3.2
Nuts	1 tbsp. peanut butter; 8 to 15 halves walnuts; 16 peanuts; 12 to 15 almonds; 12 halves pecans	15	95	3.5	8	3	.01	.06	.3	—	—	.03	.02	1.4

Sweets: candy: sugar; syrup	1 tbsp. sugar, jelly, jam, syrup, honey; 1 serving plain Jello; plain candy (fondant or mints, 14 gm.); 6-oz. bottle soft drink		55	—	—	14	—	—	—	—	—	—	—	—
candy bar	1 2-oz. chocolate-coated bar		275	5.0	13	35	.05	.10	1.4	—	—	.03	.09	3.3
molasses; sorghum	1 tbsp.	20	50	—	—	12	.04	.01	1.3	—	—	.01	.04	—
Vegetables: cabbage: sauerkraut, cooked	⅔ c.	100	25	1.5	—	5	.05	.03	.5	30	28*	.05	.04	.2
cabbage, raw: cauliflower, cooked	1 c. cabbage (50 gm.); ⅔ c. cauliflower (70 gm.)		15	1.0	—	3	.02	.02	.3	20	26	.04	.03	.1
corn; parsnips, cooked	½ c. corn; 1 large parsnip	100	95	2.0	1	20	.02	.07	.4	75	6	.04	.05	.6
green and yellow; asparagus, cooked	⅔ c.	100	25	2.0	—	4	.02	.04	.9	775	38†	.14†	.11	1.0
broccoli, cooked	⅔ c.	100	35	3.5	—	6	.15	.08	1.4	4,800	63	.08	.28	.6
carrots, cooked	⅔ c.	100	40	1.0	—	9	.04	.04	.8	12,000	3	.04	.06	.5
green beans, cooked	½ c.	100	40	2.5	—	8	.06	.04	1.4	480	13†	.06†	.12	.4
leafy green, cooked	⅔ c. kale, spinach, turnip, other greens	100	30	2.5	—	4	.25‡	.05	2.7	6,285	46†	.08†	.27	.5
peas, fresh, cooked, canned	½ c.	100	70	4.5	—	12	.02	.09	1.4	590	11†	.15†	.09	1.1
sweet potato, cooked	½ large	100	130	2.0	1	28	.04	.05	.7	5,920	14	.08	.06	.5
potato, cooked	1 small; for fried add 1 serving fats	100	85	2.0	—	19	.01	.05	.7	35	8	.08	.03	1.0
tomato, fresh, canned, juice	½ c.; 1 small tomato (100 gm.); 2½ tbsp. catsup (50 gm.) add ½ serving sweets		20	1.0	—	4	.01	.02	.6	990	19	.05	.03	.7
other, cooked	½ c. beets, eggplant, onions, rutabagas, etc.	100	45	1.5	—	10	.04	.04	.6	—	8	.01	.02	.2
other, commonly served raw	2 pieces celery; 8 sl. cucumber; ¼ hd. lettuce	50	10	0.5	—	2	.02	.01	.2	70	3	.03	.02	.1

The nutritive value of food mixtures such as macaroni and cheese, Spanish rice, chow mein, creamed vegetables, soups, etc. should be computed on the basis of the kind and approximate amount of the foods in the combination. *For sauerkraut, omit ascorbic acid. †For canned, reduce ascorbic acid and thiamin by one half. ‡Calcium unavailable in chard, spinach, and beet greens.

FOREWORD TO TABULATION OF FOOD COMPOSITION

Complete understanding as to sources and the methods used in expressing values in any food table is important. Notations should be carefully read.

In consulting any tables of values for the composition of foods, certain facts must be borne in mind. The values given are probably *never exact* because of the many variables that are operative. Such tables are, however, sufficiently correct to permit reasonably significant calculations. Two separate analyses of a food rarely give the same percentage composition unless the variables have been controlled. The original composition of any food is influenced by variety, age, physical condition; the environment under which it was grown; the degree of ripeness, fertilization process employed; the conditions of storage; the method of handling; and probably also by other factors. The figures determined are influenced by method of analysis and the factors used in calculation of the final result. A third difference may arise in the portion of the food analyzed, whether it was analyzed in its entirety as purchased (A.P.) with gross refuse removed, or whether only the edible portion (E.P.) was analyzed. Lastly, there is the problem of physiological utilization of a food. Its chemical composition is not necessarily a measure of its biological availability, nor is it a measure of the utilization of the food, which varies with the individual consuming it.

Therefore, the food tables that follow must be considered as indicating the approximate average food values for the foods listed, and no more than that. To assume that the calculations are exact and that they are to be followed meticulously, would be placing too great dependence on them. To quibble over a decimal place, or whether the factors should be 4, 4, and 9, or 4.1, 4.1, and 9.3, in a field where values vary over so wide a range, is a dreary waste of time.

In the tables which follow, whole numbers are used for the values of protein, fat, carbohydrates, and calories, and *average* figures are used for composition, except for Special Foods, in which case exact manufacturers' figures are quoted. Insofar as was possible, original sources of analyses were used as the basis for the composition values given in the following table.

The small tabulation below is inserted to illustrate our point. The foods were taken at random.

		Protein	Fat	Carbohydrate	Water
Raisins	Max.	3.0	7.2	78.3	21.0
	Avg.	2.6	3.3	76.1	14.6
	Min.	2.3	0.5	71.3	7.0
Round of beef, lean	Max.	24.1	10.0	--	73.6
	Avg.	21.3	7.9	--	70.0
	Min.	18.8	5.1	--	65.8
Green peas	Max.	8.0	0.6	18.9	78.1
	Avg.	7.0	0.5	16.9	74.6
	Min.	4.4	0.3	13.4	71.6

Pierce, in his studies on mineral content of food (J. Nutrition 20: 243, Sept., 1940), finds similar variation in mineral content of foods. Word and Wakeham (quoted from Macy, et al.: J. Nutrition 24: 41, 1942) have reported that while the calcium, phosphorus, and sulfur contents of some foods vary by only 25 per cent or less, for others the variation may be as great as 200 per cent. Such variation does not indicate unreliable data but rather an inherent variation which exists even in foods of the same variety. McCance and his co-workers found that the *available* carbohydrate of a food is less than the total carbohydrate given in American food tables. This latter value, *"obtained by difference,"* includes fiber and nonutilizable carbohydrate. Evidently the values for carbohydrate content of fruits and vegetables currently used are too high.

For fat, McCance finds that values vary greatly with the method used. For example:

	Soxhlet method	von Liebermann's method
	%	%
All Bran (Kellogg)	1.0	4.5
Flour, whole meal	0.6	2.1
Biscuits, digestive	13.3	20.5

Williams and others (J. Nutrition 19: 593, 1941) discuss the carbohydrate values of fruits and vegetables. These investigators also state that carbohydrate values usually reported for these foods are too high.

The range of values reported for vitamins is wide, due to the many factors which influence vitamin content. The vitamin values, found experimentally or by analysis, always cover a wider range than for any other food constituents. The *average* of reported values is used in this table with full appreciation of the fact that deviation exists in both directions.

To illustrate how variable the vitamin content of a food may be, the following table published in Farm Research by Slate and Robinson of the Geneva, N. Y., Experiment Station, is quoted:

ASCORBIC ACID (VITAMIN C) CONTENT OF STRAWBERRY VARIETIES GROWN AT GENEVA IN 1945

VARIETY	MG. ASCORBIC ACID PER 100 GRAMS OF FRUIT
Catskill	81
Vanrouge	77
Tenn. Shipper	75
Tenn. Beauty	75
Redwing	73
Daybreak	73
Dresden	72
Mastodon	71
Valentine	71
Robinson	70
Redheart	69
Camden	69
Sparkle	65
Suwanee	68
Gem	65
Midland	64
Temple	63
Fairfax	62
Crimson Glow	62
E. Roosevelt	59
Massey	58
Paymaster	58
Maytime	57
Julymorn	57
Starbright	55
Brightmore	55
Pathfinder	55
Howard	54
Bliss	54
Tenn. Supreme	54
Boquet	53
Clermont	50
Dorsett	49
Culver	49
Marshall	49
Cato	45
Aberdeen	41

When food has been cooked, or when recipes have been compounded, the variables are increased, and unless the effect of the method is known, or the ingredients in that food are actually calculated, the assumed value is only approximate.

If the calorie value of a food is calculated from the percentage composition (P. × 4 cal. + F. × 9 cal. + C. × 4 cal.), discrepancies will be found between the value so determined and the value given in this tabulation. This difference arises from the fact that the calorie values recorded in Table

125 are those given in the original source table, in which the decimal values figured in the calculation. Therefore, the use of the nearest whole number alone would slightly modify the calculated caloric value, but by not more than 5 calories on any 100 gm. portion—a variation too insignificant to be of importance, and far less than that found between two tables of composition.

The inclusive tabular style of presentation of data is that originally worked out as a graduate research project by Hawley, Maurer, and Van Epps and distributed in multigraph form by the Department of Vital Economics of the University of Rochester in 1928.

For details as to potency expression, see the footnotes.

TABLE

COMPOSITION OF FOODS,

Protein, Fat, Carbohydrate, Water, and Fiber are Expressed as Percentage or Grams per 100 Grams (Approx. 3.5 oz.)

FOODS	PROTEIN (GM.)	FAT (GM.)	CARBOHYDRATE (GM.)	WATER (GM.)	FIBER (GM.)	CALORIES (APPROX.)
Bread						
1. Biscuit, baking powder 5⅓ small	7	13	46	31	*	329
2. Boston brown 2 slices (¾×3 in. diam.)	5	3	41	48	*	207
3. French 5 slices	8	1	55	34	*	263
4. Gluten 4 slices	25	4	30	39	*	255
5. Graham 3¼ slices (⅜×4×3¼ in.)	10	4	48	37	1	262
6. Rolls, average white 2	8	6	54	29	*	304
7. Rusks, toasted 6⅔ slices	13	7	71	7	1	404
8. Rye, light 4 slices	6	3	52	38	*	263
9. Rye, pumpernickel 3⅓ slices	7	1	50	41	1	236
10. White, enriched 4 slices	9	2	52	36	*	261
11. Whole wheat 3½ slices	10	4	48	37	1	268
12. Zweiback 5 slices (3×1¼ in.)	11	9	73	5	*	418

Any bread made with "enriched" flour (flour to which synthetic vitamins have been added) will have added values as follows: thiamine 0.22 to 0.44 mg. (220 to 440 micrograms or gamma); niacin 0.88 to 1.76 mg. and iron 0.88 to 3.5 mg. per 100 gm. bread (4 slices). If irradiated, it also has 5.5 I. U. vitamin D per 100 gm.

If the bread is made with Fleischmann's new Hi-B_1 yeasts and unpadded flour, the potency will be increased to approximately 270 micrograms vitamin B_1, 130 micrograms B_2, 2 mg. nicotinic acid, and 2 mg. iron per 100 gm. Additional riboflavin may also be added in the near future. Obviously the combination of an "enriched" flour and Hi-B_1 yeast will further increase the potency of the bread product.

FOODS	PROTEIN (GM.)	FAT (GM.)	CARBOHYDRATE (GM.)	WATER (GM.)	FIBER (GM.)	CALORIES (APPROX.)
13. White, powdered skim milk (2 gm./100 gm. bread), regular yeast, and dough conditioner 4 slices	12	2	52	36	*	269
14. White, powdered skim milk (4 gm./100 gm. bread), regular yeast, and dough conditioner 4 slices	14	2	52	36	*	277
15. White, powdered skim milk (4 gm./100 gm. bread), Hi-B_1 yeast 4 slices	14	2	52	36	*	277
16. White, water, flour, regular yeast 4 slices	10	2	52	36	*	261

*Data given are expressed as the nearest whole number for average composition of protein, fat, carbohydrate, water, fiber, and calories.

Where no value is available for a food constituent the space is left blank. This does not mean that the food is inert in this particular substance, but only that no value has yet been found.

If a food constituent is known to be entirely absent, the fact is indicated by a zero.

If a value is less than 1%, the asterisk (*) is used to indicate it.

125*
Edible Material
Minerals are Recorded as Milligrams and Vitamins are Expressed on Various Bases

CALCIUM (MG.)	PHOSPHORUS (MG.)	IRON (MG.)	VITAMIN A (I. U.)	THIAMINE (μg)	RIBOFLAVIN (μg)	ASCORBIC ACID (MG.)	NIACIN (MG.)	REMARKS
62	97	0 5	?	8	65	Cereal products are devoid of vitamin C		
129	185	3 0	+	140	70			
27	93	0.9	?	70	65			
			?	+	+			
50	218	2.5	+	225	+			
56	100	1 8	[illegible]	240	150			
			?	+	+			
24	96	0.8	0	160	40		1 1	
			+	210	+			Not enriched
56	100	1.8	0	240	150		2 2	
60	370	2 6		230	150		3.5	400 vitamin B_6 curative units

If wheat germ is added to patent flour, it produces a bread containing from 150 to 200 micrograms vitamin B_1 and 40 to 50 B_2 per 100 gm. (bread is 60% flour).

Still another bread, made from "Earle Process" flour, which is prepared from wheat with only the first bran layer removed, has a vitamin B_1 content around 400 micrograms per 100 gm., and a mineral content comparable to whole wheat bread (twice that of a patent flour).

The effect of variation in ingredients is evidenced by the values calculated (to the basis of 100 gm.) from data prepared by Standard Brands, Inc. Similar variation can now occur, depending upon the use of the new "padded" ingredients.

48	95	0.7	+	51	100			Values from Standard Brands, Inc.
72	116	0.7	+	57	130			Values from Standard Brands, Inc.
72	116	0 7	+	310	130			Values from Standard Brands, Inc.
71	72	0.7	?	44	68			Values from Standard Brands, Inc.

Carbohydrate values quoted are total carbohydrate (by difference) exclusive of fiber which is indicated in another column.

Vitamin values are expressed on a weight basis (micrograms or gamma) for thiamine and riboflavin; as milligrams for ascorbic acid and niacin. Vitamins A and D are expressed as International units. Vitamin B_6 or pryidoxine is expressed as curative units. Where the vitamin is known to exist, but no numerical value has been determined, the fact is indicated by the plus sign.

The data used in compilation of this table were obtained from the sources indicated in the list at the end of the table

Table 125*

FOODS	PROTEIN (GM.)	FAT (GM.)	CARBOHYDRATE (GM.)	WATER (GM.)	FIBER (GM.)	CALORIES (APPROX.)
Bread—Continued						
17. Whole wheat, water, flour, regular yeast 4 slices	10	1	50	38	1	249
18. Whole wheat, powdered skim milk (2 gm./100 gm. bread), regular yeast, and dough conditioner 4 slices	12	1	50	38	1	253
Cake						
1. Angel 2½ pieces (1¼×2×2½ in.)	8	*	59	32	0	268
2. Fruit, large 3¾ pieces (1⅞×1⅞×⅜ in.)	5	14	60	29	1	380
3. Gingerbread 2 pieces (2×2×1 in.)	4	12	46	30	0	308
4. Plain 3 cubes (1¾ in. sq.)	6	8	57	27	*	327
5. Plain, frosted 2 pieces (2½×2×2 in.)	5	6	62	25	*	322
6. Pound 1 piece (2×2×1 in.)	7	24	49	19	*	440
7. Rich 1 piece (4×2×2 in.)	5	18	54	22	*	398
8. Rich, frosted 1 piece (4×2×2 in.)	4	15	58	21	*	383
9. Sponge 3¾ pieces (1½×1½×2 in.)	8	5	54	32	*	293
Cereals						
1. Barley, entire ¾ c. scant	8	1	79	11	3	357
2. Corn flakes 3½ c.	8	1	80	9	1	359
3. Corn meal, yellow ⅝ c.	8	1	78	12	1	356
4. Farina, raw ⅝ c.	12	1	76	11	*	359
5. Gerber's cereal 3½ c.	15	1	74	3	2	364
6. Hominy, cooked or canned ½ c. scant	2	*	15	83	*	69
7. Hominy, raw ½ c.	9	1	79	11	*	357
8. Macaroni, cooked, plain ½ c.	4	*	19	75	*	96
9. Macaroni, milk, dry ⅔ c.	2.2		74	11	*	369
10. Maltex ⅞ c.	17	2	76	5	2	380

—Continued

CALCIUM (MG.)	PHOSPHORUS (MG.)	IRON (MG.)	VITAMIN A (I. U.)	THIAMINE (μg)	RIBOFLAVIN (μg)	ASCORBIC ACID (mg.)	NIACIN (MG.)	REMARKS
35	255	2.5	+	300	130			Values from Standard Brands, Inc.
70	275	2.5	+	310	165			Values from Standard Brands, Inc.
62	126	2.0	0	30	10	0	0.7	
16	189	2.0	0	120	80	Cereals proper contain no vitamin C. Their growing sprouts, however, are rich sources of this vitamin.	3.1	140 mg. choline 1 mg. pantothenic acid
10	56	1.0	0	160	80		1.6	
10	140	1.0	300	150	60		0.9	42 mg. choline 0.8 mg. pantothenic acid 400 vitamin B_6 curative units
21	125	0.8	0	60	60		1.0	
819	657	30.0		1,400	+			
2.0	15	0.2						
1.0	144	0.9		210			0.9	
45	179	2.2	0	160	90		2.0	Values from Quaker Oats Co.
53	267	3.8		500	152		0.5	

TABLE 125*

FOODS	PROTEIN (GM.)	FAT (GM.)	CARBOHYDRATE (GM.)	WATER (GM.)	FIBER (GM.)	CALORIES (APPROX.)
Cereals—Continued						
11. Manioc starch (tapioca) ⅝ c.	1	*	86	13	*	350
12. Noodles (egg) dry ⅚ c.	11.9	4.6	72.3	9.8	0.16	378
13. Oatmeal or rolled oats, raw 1¼ c.	14	7	68	8	1	396
4. Oatmeal, cooked ½ c. scant	2	1	11	85	*	62
15. Pablum 3⅓ c.	15	3	69			370
16. Rice, brown, raw ⅝ c.	8	2	78	12	1	356
17. Rice flakes 3 c.	7	*	83	9	1	363
18. Rice, puffed 6⅔ c.	7	*	83	9	*	363
19. Rice, white, cooked ½ c.	2	*	23	74	*	102
20. Rice, white, raw ⅝ c.	8	*	79	12	*	351
21. Rice, wild ⅝ c.	14	1	76	9	1	364
22. Rye, whole 1 c. scant	11	2	75	10	2	361
23. Sago meal ⅝ c.	1	*	84	15	*	341
24. Starch, corn, arrowroot, etc. ¾ c.	1	*	87	12	1	352
25. Wheat cereals, bran flakes 3⅓ c.	12	2	78	6	3	372
26. Wheat cereals, Pettijohn's 1¼ c.	12	2	76	9	2	368
27. Wheat cereals, puffed wheat 6⅔ c.	12	2	78	6	2	372
28. Wheat cereals, Ralston's, whole wheat ⅝ c.	13	2	71	17	2	350
29. Wheat cereals, shredded wheat 3⅓ biscuits	10	1	79	8	2	369
30. Wheat cereals, wheat bran (crude) 1⅓ c.	17	4	64	10	10	354
31. Wheat cereals, wheat bran (packaged) 3⅛ c.	16	4	66	7	8	366
32. Wheat cereals, wheat bran (washed) 3⅛ c.	16	5	67	7	17	380

—Continued

CALCIUM (MG.)	PHOSPHORUS (MG.)	IRON (MG.)	VITAMIN A (I. U.)	THIAMINE (μg)	RIBOFLAVIN (μg)	ASCORBIC ACID (MG.)	NIACIN (MG.)	REMARKS
12	12	1.0				Cereals proper contain no vitamin C. Their growing sprouts, however, are rich sources of this vitamin.		
32	193	2.4	180	130	110		2.3	Values from Quaker Oats Co.
54	365	5.2		550	140		1.1	0.25 mg. B_6 150 mg. choline 0.015 mg. para-aminobenzoic acid 30 mg. inositol 1.3 mg. pantothenic acid
10	70	1.3		95	130			50 vitamin B_6 curative units
0.78	0.62	0.030		333				Mead Johnson & Co., Evansville, Ind.
39	303	5.5		290	50		4.6	
9	92	0.9		50	30		1.4	
9	92	0.9		50	30		1.4	
3	25	0.3						
9	92	0.7		50	30		1.4	94 mg. choline 0.4 mg. pantothenic acid
								Wild rice does not belong to the rice family but is the seed of a wild grass.
			+	++			13.0	1.3 mg. pantothenic acid
33	353	3.7		150	120		4.2	143 mg. choline
38	385	3.8		450	130		4.6	
33	353	3.7		150	120		4.2	
45	373	28.0		140	204		5.0	Source of vitamin E
38	385	3.8		200	140		4.2	
102	1340	11.6	+	400	462		21.2	2-3 mg. pantothenic acid

Table 125*

FOODS	PROTEIN (GM.)	FAT (GM.)	CARBOHYDRATE (GM.)	WATER (GM.)	FIBER (GM.)	CALORIES (APPROX.)
Cereals—Continued						
33. Wheat cereals, wheat flakes 3 c.	12	2	78	6	2	372
34. Wheat cereals, wheat germ 1 c. scant	25	10	50	11	3	389
35. Wheat cereals, wheat, ground, cut or cracked 1 c. scant	12	2	76	9	2	368
36. Wheat, cream of, enriched 5/8 c.	12	1	73	11	*	351
Crackers						
1. Cheese Varies with size	16	12	64	4	*	425
2. Crisp, thin, rich, any flavor including chocolate 33 crackers (Ritz)	10	10	73	5	*	422
3. Graham 12 large	8	10	74	6	1	419
4. Ry-Krisp 15 3/5 wafers	12	1.2	74.0			355
5. Oyster 2 2/3 c.	10	10	73	6	*	416
6. Saltines 15 double	9	12	71	5	*	427
7. Soda, plain (N. B. C.) 15	10	10	73	6	*	416
8. Soft, thick, any flavor Varies with size	7	11	73	9	*	414
9. Sweet tea biscuit 20 ± according to kind	8	11	76	5	*	432
10. Water crackers, shortened 10	10	5	77	7	*	391
11. Whole wheat wafer 20	8	10	74	6	1	419
Dairy Products						
1. Butter 10 pats (1×1×1/2 in.)	1	81	*	16	0	733
2. Cheese, American Cheddar 1 slice (4 1/2×1 1/8×1 1/8 in.) 7/8 c. grated	24	32	2	39	0	393
3. Cheese, Camembert Sector (2 1/2×2×2 1/4 in. radius)	24	32	12	39	0	393
4. Cheese, cottage, skim milk 1/2 c. scant (6 tbs.)	19	1	4	74	0	101
5. Cheese, Cream 1 1/6 pkg.	7	37	2	53	0	368
6. Cheese, Edam 1 slice (1 1/4×1 1/4×4 in.)	24	32	2	39	0	393

—Continued

CALCIUM (MG.)	PHOSPHORUS (MG.)	IRON (MG.)	VITAMIN A (I. U.)	THIAMINE (µg)	RIBOFLAVIN (µg)	ASCORBIC ACID (MG.)	NIACIN (MG.)	REMARKS
33	353	3.7		150	120	Cereals proper contain no vitamin C. Their growing sprouts, however, are rich sources of this vitamin.	4.2	
71	1050	10.0		2,800	800		4.2	1 mg. B_6 1.2-1.5 mg. pantothenic acid
38	385	3.8		450	130		5.0	0.46 mg. B_6 1.1 mg. pantothenic acid
21	125	0.8		60	60		1.0	
						Cereal products do not contain ascorbic acid		
22	102	1.5		70			0.6	
20	203	1.9		300	120		1.5	
60	375	4.5		285	225		2.25	
22	102	1.5		70			0.6	
25	100	1.5						
22	102	2.0						
22	65	0.6		40	40		0.5	
20	203	1.9		300	120		1.5	
16	16	0.2	3,300		10	0	0.1	40-150 I. U. vitamin D 200 curative units vitamin B_6
873	610	0.6	1,740	40	500	0	0.2	250 curative units vitamin B_6 15-19 mg. choline Mineral values given are for "hard cheese"
873	610	0.6	2,050	40	520	0	1.6	0.06 mg. biotin
82	263	0.5	30	20	290	0	0.1	
298	208	0.2	2,210	10	140		0.6	0.012 mg. biotin 1.40 mg. pantothenic acid
873	610	0.6	2,050	40	520	0	0.2	

TABLE 125*

FOODS	PROTEIN (GM.)	FAT (GM.)	CARBOHYDRATE (GM.)	WATER (GM.)	FIBER (GM.)	CALORIES (APPROX.)
Dairy Produts—Continued						
7. Cheese, Liederkranz 3½ oz.	24	32	2	39	0	393
8. Cheese, Limburger ½ c. scant (6-7 tbs.)	24	32	2	39	0	393
9. Cheese, Neufchâtel, cream 5 cubes (1×1×¾ in.)	7	37	2	53	0	367
10. Cheese, Parmesan 1 slice (1×1×5 in.)	24	32	2	39	0	393
11. Cheese, Roquefort 1 slice (1½×1¼×3½ in.)	22	33	1	37	0	376
12. Cheese, Swiss 1 slice (4½×3½×½ in.)	24	32	2	39	0	393
13. Cheese, Velveeta 1 slice (4½×1⅛×1⅛ in.)	22	32	2	38	0	382
14. Cream, 20%, "Coffee" 2/5 c.	3	20	4	73	0	210
15. Cream, 40%, "Whipping" 2/5 c.	2	40	3	59	0	380
16. Milk, acidophilus 2/5 c.	3	2	4			46
17. Milk, buttermilk, churned from cream 2/5 c.	4	1*	5	91	0	45
18. Milk, buttermilk, cultured, skim 2/5 c.	4	*	5	91	0	36
19. Milk, condensed, sweetened ¼ c.	8	8	55	27	0	327
20. Milk, evaporated, unsweetened 6⅔ tbs.	7	8	10	74	0	139
21. Milk, human 2/5 c.	2	3	7	88	0	63
22. Milk, koumiss 2/5 c.	3	2	6	90	0	265
23. Milk, malted, dry ¾ c.	15	9	71	3	0	418
24. Milk, powdered, skim ¾ c.	36	1	52	4	0	359
25. Milk, powdered, whole ¾ c.	26	27	38	4	0	496
26. Milk, skim, fresh 2/5 c.	4	*	5	91	0	36

—Continued

CALCIUM (MG.)	PHOSPHORUS (MG.)	IRON (MG.)	VITAMIN A (I. U.)	THIAMINE (μg)	RIBOFLAVIN (μg)	ASCORBIC ACID (MG.)	NIACIN (MG.)	REMARKS
873	610	0.6	2,050	40	520	0	0.2	
873	610	0.6	2,050	40	520	0	1.4	0.4 mg. biotin 5.8 mg. pantothenic acid
298	298	0.2	2,210	10	140	0	0.1	
873	610	0.6	2,050	40	520	0	0.2	
873	610	0.6	2,050	40	520	0	12.4	0.08 mg. biotin 9.6 mg. pantothenic acid
873	610	0.6	2,050	40	520	0	0.7	0.01 mg. biotin 2.6 mg. pantothenic acid
716	831	0.8	1,260	30	430	Dairy products contain but small amount, if any, ascorbic acid.	1.4	0.05 mg. biotin 5.5 mg. pantothenic acid
97	77	0.06	830	30	140	1±	0.1	13 I. U. vitamin D
99	77	0.2	2,200	30	145	1±		27 I. U. vitamin D
			+	+	+			
122	97	0.3	+	6	180			0.35–0.56 mg. pantothenic acid
118	93	0.07	+	40	180	1	0.1	
273	228	0.20	430	50	390	0	0.2	
243	195	0.17	400	50	360	0	0.2	Irradiated, evaporated, 135 I. U. vitamin D per pint can
20	20	0.15						
357	345	2.1	4,500	450	655			79 I. U. vitamin D
1,300	1,030	0.6	40	350	1,960	7	10.5	56 curative units vitamin B_6 159 mg. choline
949	728	0.6	1,400	300	1,460	6		63 I. U. vitamin D 107 mg. choline
118	93	0.07	+	40	180	2 (raw) 1 (past.)		14 curative units of vitamin B_6 0.2-0.4 mg. pantothenic acid

Table 12

Foods	Protein (gm.)	Fat (gm.)	Carbohydrate (gm.)	Water (gm.)	Fiber (gm.)	Calories (approx.)
Dairy Products—Continued						
27. Milk, whey 2/5 c.	1	*	5	93	0	27
28. Milk, whole, fresh 2/5 c.	4	4	5	87	0	69
Fats						
1. Cod-liver oil 7 tbs. (1 tbs. = 15 gm.)	0	100	0	0	0	900
2. Corn, cottonseed, olive and peanut oils 9 tbs.	0	100	0	0	0	900
3. Crisco 8⅓ tbs.	0	100	0	0	0	900
4. Lard, refined 6⅔ tbs.	0	100	0	0	0	900
5. Oleomargarine, vitamin A added 7¾ tbs.	1	81	*	16	0	733
6. Spry 8⅓ tbs.	0	100	0	0	0	900
7. Suet, beef	2	93	0	5	0	844
Fish						
1. Blue, cooked 1 (3×2¼×1 in.)	19	1	0	75		89
2. Caviar, canned 5 tbs.	27	15	0	46		243
3. Clams, meat only, round 6 (½ c.)	11	1	6	81		77
4. Codfish, raw 1 (2⅛×2⅜×1⅛ in.)	17	0	0	83		68
5. Codfish, salt 1 (4½×2½×½ in.)	17	0	0	53		68
6. Crab, hard shell, fresh or cooked ½ c.	20	3	1	80		107
7. Crab meat, canned ⅔ c.	10	2	1	77		62
8. Haddock, raw 1 (2⅛×2⅜×1⅛ in.)	17	0	0	82		68
9. Haddock, smoked 1 (4×1½×1 in.)	22	2	0	73		106
10. Halibut, raw 1 (3×2¼×1 in.)	19	5	0	75		121
11. Herring, fresh, raw ½ medium fish	19	7	0	73		139

–Continued

CALCIUM (MG.)	PHOSPHORUS (MG.)	IRON (MG.)	VITAMIN A (I. U.)	THIAMINE (μg)	RIBOFLAVIN (μg)	ASCORBIC ACID (MG.)	NIACIN (MG.)	REMARKS
44	35							0.2-0.6 mg. pantothenic acid
118	93	0.7	160	10	170	2 (raw) 1 (past.)	0.1	Irradiated 13.5 I. U. vitamin D Fortified 40 I. U. vitamin D 0.5 mg. pyridoxine 0.1-.015 mg. para-aminobenzoic acid 0.1-0.5 mg. pantothenic acid 14.7 mg. choline 7 mg. inositol
			80,000–300,000 I. U. A and 8,000–30,000 I. U. D (10:1)					U. S. P. Standard 850 units vitamin A and 85 vitamin D units per gm.
			0					Corn 2,000 vitamin B_6 curative units Peanut 5,000 vitamin B_6 curative units
			0					Hydrogenated cottonseed oil
			0					
2	15	0.2	1,980					
			0					
23	236	1.1		+	200	The minute quantities of vitamin C, originally present in fish muscle, are lost before consumption of the fish; therefore, fish may be considered as devoid of this vitamin		
30	300	1.4						
106	116	4.4	20	30	15			5 I. U. vitamin D
18	189	0.9		40	50		2-3	5 mg. biotin
10	189	3.0		100	70		2.1	
18	191	1.0		+	200			
12	116	0.5						
18	189	0.9		40	50		2.3	40 vitamin B_6 curative units
23	255	1.1						
8	200	1.0		84-180	200		6	
21	224	1.1		105	200		3.5	

Table 125

Foods	Protein (gm.)	Fat (gm.)	Carbohydrate (gm.)	Water (gm.)	Fiber (gm.)	Calories (approx.)
Fish—Continued						
12. Herring, smoked ½ medium fish	20	12	0	35		188
13. Lobster, canned ¾ c. scant	18	1	0	77		87
14. Lobster, fresh, cooked ¾ c. scant	16	2	0	79		84
15. Mackerel, fresh 1 (2⅛×1⅛×2⅜ in.)	22	8	0	73		160
16. Mackerel, salted ⅛ medium fish	18	25	0	43		297
17. Mackerel, smoked ⅓ medium fish	24	13	0	59		212
18. Oysters, solids and liquor 4 to 5 large (½ c.)	6	1	4	87		50
19. Perch, white 1 medium (4 in. long)	19	4	0	76		113
20. Perch, yellow 1 medium (4 in. long)	19	1	0	80		85
21. Pickerel 1 (3×2¼×1 in.)	19	1	0	80		79
22. Salmon, canned, flaked, pink 1 c. scant	21	10	0	67		174
23. Salmon, fresh 1 (3×4×¾ in.)	17	17	0	65		221
24. Sardines, canned, drained 11 (3 in. long)	24	22	0	51		294
25. Scallops ½ c. (10-15)	15	0	3	80		72
26. Shad, fresh 1 (3½ in. cross section from back)	19	10	0	71		163
27. Shad roe ½ medium	22	4	0	71		124
28. Shrimp, drained, solids ¾-1 c.	18	1	1	78		85
29. Smelt, raw 1 fish (6 in. long)	18	2	0	77		81
30. Sole, raw (flounder) 1 (4×4×¾ in.)	14	1	0	80		65
31. Trout, brook 1 (2½×1⅛×2⅜ in.)	19	2	0	78		96
32. Trout, lake 1 (2½×1⅛×2⅜ in.)	19	2	0	71		94
33. Tuna, canned, drained ¾ c.	28	12	0	58		220
34. Whitefish, Great Lakes 1 (2½×1⅛×2⅜ in.)	23	7	0	70		155

Fish is also valuable for its iodine content.

Fish (on the average) is estimated by Sherman to contain 0.109 gm. calcium, 1.148 gm. phosphorus, and 0055 gm. iron per *100 gm. of protein*. On this basis, for each 20 gm. of protein (the average listed here), the values

—Continued

CALCIUM (MG.)	PHOSPHORUS (MG.)	IRON (MG.)	VITAMIN A (I. U.)	THIAMINE (μg)	RIBOFLAVIN (μg)	ASCORBIC ACID (MG.)	NIACIN (MG.)	REMARKS
40	423	2.0				The minute quantities of vitamin C, originally present in fish muscle, are lost before consumption of the fish; therefore, fish may be considered as devoid of this vitamin		
62	283	1.4						
62	283	1.4						
11	273	0.9		+	200		6.0	
68	172	0.71		180	230		1.2	5 I. U. vitamin D
20	215	1.0		90	70		1.7	
67	286	1.3	80	30	180		6.5	400-800 I. U. vitamin D 0.7 mg. pantothenic acid
13	242	1.0	290	210	140		6–8	400-800 I. U. vitamin D 6 mg. biotin
30	252	1.5	130	40	110		9.2	
115	40	3.0		+			1.4	
20	216	1.0			200			
23	242	1.2	3,100	250				
75	210	2.0	60	10	30		1.9	
19	202	1.0		+	200			
36	163	0.8						
21	220	1.1		90	50		3.5	
34	290	1.7	70	40	130		10.6	
150	263	0.4						

would be 0.0212 gm. calcium, 0.2296 gm. phosphorus, and 0.0011 gm. iron. When values do not appear, the average may be used or the value calculated on this basis for the protein content given.

Table 125*

FOODS	PROTEIN (GM.)	FAT (GM.)	CARBOHYDRATE (GM.)	WATER (GM.)	FIBER (GM.)	CALORIES (APPROX.)
Flours						
1. Corn meal, whole ground, yellow ¾ c.	9	4	74	12	2	365
2. Corn meal, white, bolted, degerminated ¾ c.	8	1	79	12	1	355
3. Corn meal, yellow, bolted, degerminated ¾ c.	8	1	78	12	1	356
4. Potato ⅔ c.	1	*	83			345
5. Rice ⅔ c.	7	*	80	12	*	352
6. Rye, light ¾ c.	7	1	79	11	2	358
7. Soybean, high fat 1¼ c. scant	36	21	11	9	3	377
8. Soybean, medium fat	43	7	14	8	3	292
9. Wheat, graham, all types ¾ c.	13	2	72	11	2	360
10. Wheat, patent, all purpose ¾ c.	11	1	76	12	*	355
11. Wheat, bread, enriched ¾ c.	12	1	75	12	*	356
12. Wheat, cake or pastry ¾ c.	8	1	79	12	*	354
13. Wheat, self-rising 1 c. scant	10	2	72	11	1	344
14. Wheat, prepared with shortening	8	12	66	10	*	406
15. Wheat, whole ¾ c.	13	2	73	9	2	362
Fruits						
1. Apple 1 small	*	*	15	84	1	60
2. Apricots, dry 10–15 halves	5	1	67	29	2	297
3. Apricots, fresh 2 avg. size	1	*	13	85	*	56
4. Avocado ½ of 4 in. fruit	2	26	5	65	2	265
5. Banana 1 small	1	*	23	75	*	96
6. Blackberries 1 c.	1	1	13	85	4	65

—Continued

CALCIUM (MG.)	PHOSPHORUS (MG.)	IRON (MG.)	VITAMIN A (I. U.)	THIAMINE (μg)	RIBOFLAVIN (μg)	ASCORBIC ACID (MG.)	NIACIN (MG.)	REMARKS
18	276	2.7	510	450	170	Cereal products contain no vitamin C	2.1	4.2 mg. choline
10	140	1.0	0	160	90		1	
10	140	1.0	300	150	60			400 vitamin B_6 curative units 10 mg. choline
11	99	0.9		35				
180	278	1.3	0	150	70		0.9	1.3 mg. pantothenic acid
195	553	12.1	140	770	280		2.2	0.8-2.2 mg. pantothenic acid
244	610	13.0	110	820	340		2.6	
38	385	3.8	+	560	120		5.6	
19	93	0.7	0	70	30		1	0.2 mg. B_6 52 mg. choline 0.6 mg. pantothenic acid
20	93	2.9	0	440	260		3.5	
20	93	0.7	0	43	30		0.8	
220	330	0.6	0	20	20		0.7	
38	385	3.8	0	560	120		6	0.5 mg. B_6 pyridoxine 0.06 mg. para-aminobenzoic acid 30 mg. chlorine 1.3 mg. pantothenic acid
6	10	0.3	90	40	20	5	0.2	0.04 mg. pyridoxine 1-4 mg. inositol 0.06 mg. pantothenate
65	119	7.6	4,800	80	190	10	9.9	
16	23	0.5	2,790	30	40	4	0.7	
10	38	0.6	290	120	150	16	1.1	
8	28	0.6	430	90	60	10	0.6	66 vitamin B_6 curative units 70 mg. pantothenic acid
36	34	0.9	320	30	70	23	0.3	

TABLE 125*

FOODS	PROTEIN (GM.)	FAT (GM.)	CARBOHYDRATE (GM.)	WATER (GM.)	FIBER (GM.)	CALORIES (APPROX.)
Fruits—Continued						
7. Blueberries ⅔ c.	1	1	15	83	1	73
8. Cantaloupe, deeply colored ⅓ melon (4 in.)	1	*	5	94	1	24
9. Cherries, sweet ⅔ c.	1	1	15	80	*	73
10. Cranberries 1 c.	*	1	10	87	1	53
11. Currants, fresh ½ c.	2	*	10	85	3	61
12. Dates, dry 14 dates	2	3	74	15		331
13. Figs, dry 8–10	4	*	53	19	7	228
14. Figs, fresh 3 (1½ in. diam.)	1	*	17	78	2	72
15. Gooseberries, ripe ½ c.	1	*	9	88	3	40
16. Grapefruit ½ (4 in. diam.)	*	*	10	89	*	40
17. Grapes, American 20–25 grapes	1	*	17	82	*	72
18. Honeydew melon ¼ melon (5 in. diam.)	*	*	8	63	*	32
19. Huckleberries ⅔ c.	1	1	15	84	1	73
20. Lemon 1 (2½ in. long)	1	1	9	89	1	44
21. Loganberries 1⅙ c.	1	1	13	83	2	65
22. Muskmelon, deeply colored ¼ melon (5 in. diam.)	1	*	5	93	1	24
23. Oranges 1 (2½ in. diam.)	1	*	10	87	1	45
24. Papayas ¼ (5 in. diam.)	1	*	11	89	1	48
25. Peaches 1 medium	1	*	12	87	1	52
26. Pears 1 medium	1	*	16	83	1	68
27. Pineapple, fresh 1 slice (3 in. thick) (⅔ c. cubed)	*	*	14	85	*	58

°Carbohydrate value includes fiber.
"Water-packed" foods have a carbohydrate content approximately 4% less than the fresh or "juice-packed".

—Continued

CALCIUM (MG.)	PHOSPHORUS (MG.)	IRON (MG.)	VITAMIN A (I. U.)	THIAMINE (μg)	RIBOFLAVIN (μ)	ASCORBIC ACID (MG.)	NIACIN (MG.)	REMARKS
16	13	0.8	230	30	70	16	0.3	
17	16	0.4	3,420	60	40	33	0.8	
17	22	0.5	1,300	50	60	14	0.1	
14	11	0.6	40		+	13	0.1	
26	38	0.7	250	40	+	Black 255 Red 40		
70	58	3.6	170	75	45	0	2.2	
162	116	3.9	65	125	45	0	1.7	
51	28	0.8	80	44	52	3	0.6	
19	19	0.6				35		
17	18	0.3	+	40	20	40	0.2	
17	21	0.6	80	50	30	4	0.4	
17	16	0.4	10	50				
16	13	0.8	280	30	70	16	0.3	
14	10	0.1	0	40	+	45	0.1	
36	34	0.9	320	30	70	23	0.3	
17	16	0.4	3,420	60	40	33	0.8	
33	23	0.4	190	80	30	50	0.2	0.05 mg. pyridoxine 0.07-0.30 mg. pantothenic acid
17	13	0.3	2,500	18	24	54		
8	22	0.6	880	20	50	12	0.9	White 0-100A Yellow 1000-2000A
13	16	0.3	20	20	40	4	0.1	
16	11	0.3	130	80	20	24	0.2	

Added sugar may increase carbohydrate content markedly, depending upon sugar content of the syrup. Juice packed may be calculated as the fresh fruit itself.

Table 125*

Foods	Protein (gm.)	Fat (gm.)	Carbohydrate (gm.)	Water (gm.)	Fiber (gm.)	Calories (approx.)
Fruits—Continued						
28. Plums 3	1	*	13	86	1	56
29. Prunes, dried 5–6	2	0	71	22	2	292
30. Quinces 3 (1½ in. diam.)	*	*	12	85	2	58
31. Raisins ¾ c.	2	0	71°	15	0	292
32. Raspberries, black ¾–1 c.	1	1	13	84	4	65
33. Raspberries, red ¾ c.	1	1	13	84	3	65
34. Rhubarb 1 c. diced	*	*	4	95	1	16
35. Strawberries 10–15 (⅔ c.)	1	1	8	90	1	45
36. Tangerines 2 small (2 in. diam.)	1	*	11	89		48
37. Watermelon 1 slice (2½×2½×1 in.)	1	*	7	92	1	32

°Carbohydrate value includes fiber.
"Water-packed" foods have a carbohydrate content approximately 4% less than the fresh or "juice-packed".

Foods	Protein (gm.)	Fat (gm.)	Carbohydrate (gm.)	Water (gm.)	Fiber (gm.)	Calories (approx.)
Fruit Juices						
1. Apple 3½ oz. (approx. $^{2}/_{5}$ c.)	*	0	13	87	0	50
2. Blackberry 3½ oz. (approx. $^{2}/_{5}$ c.)	*	0	7	92	0	29
3. Blueberry 3½ oz. (approx. $^{2}/_{5}$ c.)	1	1	15	83	0	68
4. Grapefruit 3½ oz. (approx. $^{2}/_{5}$ c.)	*	*	10	89	0	42
5. Grape 3½ oz. (approx. $^{2}/_{5}$ c.)	*	0	19	81	0	76
6. Lemon 3½ oz. (approx. $^{2}/_{5}$ c.)	1	*	9	90	0	42
7. Lime 3½ oz. (approx. $^{2}/_{5}$ c.)	1	0	8	91	0	33
8. Orange 3½ oz. (approx. $^{2}/_{5}$ c.)	1	*	13	86	0	55
9. Pineapple 3½ oz. (approx. $^{2}/_{5}$ c.)	*	*	13	88	0	53
10. Raspberry, red 3½ oz. (approx. $^{2}/_{5}$ c.)	*	0	8	91	0	35

—Continued

CALCIUM (MG.)	PHOSPHORUS (MG.)	IRON (MG.)	VITAMIN A (I. U.)	THIAMINE (μg)	RIBOFLAVIN (μg)	ASCORBIC ACID (MG.)	NIACIN (MG.)	REMARKS
17	20	0.5	350	150	30	5	0.6	
54	85	3.9	1,890	100	160	3	1.7	
						7		
78	129	3.3	50	150	80	+	0.5	
36	34	0.9	320	30	70	23	0.3	
36	34	0.9	320	30	70	23	0.3	
51	25	0.5	30	10	0	9	0.1	
28	27	0.8	60	30	70	60	0.3	
33	23	0.4	420	70	30	30	0.2	
7	12	0.2	590	50	50	6	0.2	

Added sugar may increase carbohydrate content markedly, depending upon sugar content of the syrup. Juice packed may be calculated as the fresh fruit itself.

6	10	0.3	90	40	20	5	0.2	
36	34	0.9	320	30	70	23	0.3	
16	13	0.8	280	30	70	16	0.3	
17	18	0.3	+	40	20	40	0.2	
17	21	0.6	80	50	30	4	0.4	
14	10	0.1	0	40	+	45	0.1	
33	23	0.4	100	70	20	42	0.2	0.08 mg. B_6 1.5 mg. biotin 0.004 mg. inositol 0.07 mg. pantothenic acid
15	8	0.5	80	50	20	9	0.2	
36	34	0.9	320	30	70	23	0.3	

Addition of sugar increases carbohydrate value of fruit juices 1 to 3%.

TABLE 125*

FOODS	PROTEIN (GM.)	FAT (GM.)	CARBOHYDRATE (GM.)	WATER (GM.)	FIBER (GM.)	CALORIES (APPROX.)
Meats						
Beef						
1. Beef, brain, calf 1/6 of a brain	11	9	1	78		129
2. Beef, chuck 1 slice (1½×3×3½ in.)	19	16	0	65		218
3. Beef, corned, canned 2 slices (2×4×½ in.)	24	15	0	71		231
4. Beef, dried 1 c. loosely packed	34	6	0			190
5. Beef, heart 1 slice (2×3×1 in.)	17	6	1	78		126
6. Beef, kidney ½ c. diced	15	8	1	75		136
7. Beef, liver 1 slice (3¾×3×½ in.)	20	4	4	70		132
8. Beef, loin, medium lean 1 slice (4×4×½ in.)	19	13	0	57		193
9. Beef, plate and brisket 1 slice (4×½×⅛ in.)	16	30	0	53		333
10. Beef, porterhouse, medium lean 2 slices (3×2×1 in.)	22	20	0	58		273
11. Beef, rib, 82% lean 1 slice (5×2½×¼ in.)	17	23	0	59		277
12. Beef, roast, canned 2 slices (2×4×½ in.)	25	13	0	60		217
13. Beef, round, 87% lean 2 slices (3½×2×1 in.)	19	13	0	67		194
14. Beef, rump, 67% lean 2 slices (½×2×1 in.)	16	31	0	53		343
15. Beef, shank, 88% lean 1 slice (4½×½×⅛ in.)	20	9	0	69		161
16. Beef, tongue, medium lean 5 slices (¼ in. thick)	16	15	*	68		200
17. Beef, tripe 3½ oz.	19	2	0	79		94
Lamb						
1. Lamb, chops, loin 3 medium	18	18	0	51		234
2. Lamb, leg, medium fat 2 slices (1×4½×½ in.)	18	18	0	64		234
3. Lamb, liver 1 slice (¾×3×½ in.)	20	4	4	71		132
4. Mutton, chops, loin, medium fat 2 medium	16	33	0	50		375

—Continued

CALCIUM (MG.)	PHOSPHORUS (MG.)	IRON (MG.)	VITAMIN A (I. U.)	THIAMINE (μg)	RIBOFLAVIN (μg)	ASCORBIC ACID (MG.)	NIACIN (MG.)	REMARKS
16	340	5.3	54	170	300	The small amount of ascorbic acid originally present in muscle tissue is lost before the meat is consumed; therefore, meat may be considered as devoid of vitamin C	5.0	
11	200	2.8	0	120	150		5.0	
29	113	4.0	0	20	190		2.7	
20	370	5.1	0	110	220		3.7	
10	236	6.2	0	540	900		6.8	
10	180	4.0	700	200	2,000		7.5	92 mg. biotin 0.5 mg. pyridoxine 333 mg. choline
8	373	12.0	19,500	270	2,800		16.1	45 I. U. vitamin D 88-118 mg. biotin 630 mg. choline 0.6 mg. pyridoxine 4-6 mg. pantothenic acid 100 mg. inositol
10	182	2.5	0	100	130		4.6	
11	208	2.9	0	110	210		4.5	
13	204	3.0	0	85	125		4.3	0.4 mg. B_6 3.4 mg. biotin 82 mg. choline 1 mg. pantothenic acid
10	188	2.6	0	110	140		4.7	
9	164	2.2	0	20	240		4.5	
11	208	2.9	0	120	150		5.2	3-6 mg. biotin 95 mg. choline 0.2-0.4 mg. pyridoxine 1 mg. pantothenic acid 0.065 mg. para-aminobenzoic acid
9	167	2.3	0	100	120		4.2	
12	219	3.0	0	130	160		5.5	
30	119	6.9	0	220	270		5.0	3.3 mg. biotin
130	130	1.6	0	7	90		1.0	
10	194	2.7	0	210	260		5.9	6 mg. biotin 107 mg. choline
10	194	2.7	0	210	260		5.9	
8	373	12.1	19,200	270	2,800		16.1	127 mg. biotin
14	216	2.2	0	150	210		4.6	

Table 125[1]

FOODS	PROTEIN (GM.)	FAT (GM.)	CARBOHYDRATE (GM.)	WATER (GM.)	FIBER (GM.)	CALORIES (APPROX.)
Meats—Continued						
Lamb						
5. Mutton, leg, lean 2 slices (1×4½×½ in.)	20	12	0	67		196
6. Mutton, leg, medium fat 2 slices (1×4½×½ in.)	19	18	0	63		242
Pork						
1. Pork, bacon 10 slices (1½×4½×⅛ in.)	9	65	1	20		626
2. Pork, bacon, Canadian, lean 2 slices (2½×2½×¼ in.)	22	15	*	56		225
3. Pork, ham, fresh, medium fat 1 slice (4½×3×¼ in.)	15	31	*	53		340
4. Pork, ham, smoked 1 slice (4½×3×¼ in.)	17	35	*	42		384
5. Pork, heart 1 slice (2×3×1 in.)	17	6	*	77		122
6. Pork, liver 1 slice (3×6×½ in.)	20	4	4	73		132
7. Pork, loin or chops 1 chop (¾ in. thick)	16	25	0	58		291
8. Pork, salt, fat 10 slices (1½×4½×⅛ in.)	4	85	0	8		781
9. Pork, shoulder 1 slice (1¾×3×3¼ in.)	15	32	0	49		348
10. Pork, spare rib Varies with amount of bone	15	32	0	53		346
11. Pork, tenderloin 1 slice (1¾×3×3¼ in.)	20	7	0	72		143
Poultry						
1. Chicken, broiler, 1½-2 lb. live weight ½ medium broiler	21	4	0	74		122
2. Chicken, capon, over 4 lb. live weight ½ breast or 1 thigh	21	21	0	56		276
3. Chicken, giblets 1 gizzard + 1 liver + 1 heart	20	5	0	73		122
4. Chicken liver 3 livers	22	4	2	69		137
5. Chicken, roaster, over 3½ lb. live weight ½ breast or 1 thigh	20	13	0	73		197
6. Chicken, fowl 2 slices (1¾×1½×¼ in.)	21	7	0	70		149

—Continued

CALCIUM (MG.)	PHOSPHORUS (MG.)	IRON (MG.)	VITAMIN A (I. U.)	THIAMINE (μg)	RIBOFLAVIN (μg)	ASCORBIC ACID (MG.)	NIACIN (MG.)	REMARKS
14	216	2.7		250	240	The small amount of ascorbic acid originally present in muscle tissue is lost before the meat is consumed; therefore, meat may be considered as devoid of vitamin C	5.4	
14	216	2.7		250	240		5.4	
13	108	0.8	0	420	100		2.1	The fat content of cooked bacon is approximately one-half that of the raw
				480				72.9 mg. choline
9	164	2.3	0	960	190		4.1	4–7 mg. biotin 100 mg. choline 0.7 mg. pyridoxine 0.9 mg. pantothenic acid 0.08 mg. para-aminobenzoic acid
10	182	2.5	0	780	190		3.8	5–10 mg. biotin
10	236	6.2	0	540	900		6.8	18 mg. biotin
8	373	12.0	19,200	270	2,800		16.1	100 vitamin B_6 curative units 80–95 mg. biotin 5–4 mg. pantothenic acid
10	177	2.5		1,040	200		4.4	0.6 mg. B_6 curative units 77 mg. choline 1.5 mg. pantothenic acid
2	42	0.6	0	180	40		0.9	
9	160	2.2	0	940	180		4.0	
8	157	2.2	0	920	180		3.9	
8	216	3.0	0	525	358		3.8	
13	232	3.2	+	230	150			10–11 mg. biotin
				155			8.0	342 mg. choline 45 I. U. vitamin D
16	218	1.9	111	dark meat 150	250		7.0	0.2 mg. B_6 curative units 2 mg. pantothenic acid
				light meat 90	60		6.0	0.8 mg. pantothenic acid

TABLE 125 *

FOODS	PROTEIN (GM.)	FAT (GM.)	CARBOHYDRATE (GM.)	WATER (GM.)	FIBER (GM.)	CALORIES (APPROX.)
Meats—Continued						
Poultry						
7. Duck, domestic 2 slices (1¾×1½×¼ in.)	21	8	0	69		159
8. Duck, wild 2 slices (1¾×1½×¼ in.)	21	5	0	71		132
9. Goose, domestic 2 slices (1¾×1½×¼ in.)	22	7	0	68		153
10. Squab, ¾-1½ lb. live weight 1 whole bird	22	3	0	75		111
11. Turkey 2 slices (4×3×¼ in.)	20	20	0	69		260
Sausage						
1. Beef and pork link, all meat 6 sausages (3×¾ in.)	20	41	0	45		416
2. Blood 6 slices (¼ in. thick)	15	35	0	47		371
3. Bologna, all meat 6 slices (⅛ in. thick)	15	16	4	64		200
4. Frankfurters, all meat, 8 per pound 1½ sausage	15	14	3	61		198
5. Frankfurters, cereal added, 8 per pound 1½ sausage	15	14	0	64		201
6. Liver 4 slices (¼ in. thick)	17	21	2	59		258
7. Pork, no cereal 6 sausages (3×¾ in.)	16	24	0	42		280
8. Salami 6 slices (¼ in. thick)	24	37	0	31		427
9. Summer 6 slices (⅛ in. thick)	24	35	0	34		408
Veal						
1. Veal cutlet 2 slices (2×3×½ in.)	20	9	0	70		159
2. Veal, kidney 3½ oz. (½ c. cubed)	17	5	*	76		115
3. Veal, liver 1 slice (1¾×3×3¼)	19	5	0	71		136
4. Veal, loin 2 slices (2×3×½ in.)	19	11	0	69		176
5. Veal, sweetbreads 3 average	20	3	0	75		106

Meat of firm texture, no bone, and little fat, averages 6 to 9 cubic inches per 100 gm. Meat of loose texture averages 9 to 12 cubic inches per 100 gm.

The average values for the mineral content of meats, as given by Sherman, are: 0.058 grams calcium, 1.078 grams phosphorus, and 0.015 grams iron per *100 grams protein*. In as much as "meats" are, on the average, approximately 20% protein, the values 0.12 grams calcium, 0.218 grams phosphorus, and 0.003 grams iron may be used for 100 grams meat.

On the average lean muscle of meat contains 300 micrograms riboflavin, 10 milligrams niacin, 25 curative units vitamin B_6, and 1 milligram pantothenic acid per 100 grams meat.

—Continued

CALCIUM (MG.)	PHOSPHORUS (MG.)	IRON (MG.)	VITAMIN A (I. U.)	THIAMINE (µg)	RIBOFLAVIN (µg)	ASCORBIC ACID (MG.)	NIACIN (MG.)	REMARKS
						The small amount of ascorbic acid originally present in muscle tissue is lost before the meat is consumed; therefore, meat may be considered as devoid of vitamin C		
dark meat 23 light meat 21	422 324	5.9 5.2		120	190		7.9	
9	160	2.2	0	310	300		3.0	
9	164	2.3		190	230		2.4	
9	238	5.4	5,750	170	1,120		4.6	
17	131	2.2		190	210		2.8	48 mg. choline
11	210	2.9		180	280		6.4	
16	287	6.5	750	450	2,550			348 mg. choline
11	368	8.2	7,000	150	2,800		17	652 mg. choline
11	207	2.9		180	270		6.3	113 mg. choline

Elvehjem and his associates report the average vitamin retention in cooked pork, ham, and loins as: in the meat alone, 70% of the thiamin in roasting and broiling and 50% in braising; for niacin in roasting and broiling 85%, in braising 65%. For riboflavin there is 85% retention with any of the methods. The total retention in the meat plus the drippings is about the same for all methods—an average of 70% for thiamine and at least 90% for riboflavin and niacin. Appreciable amounts of each of the vitamins are found in the drippings, particularly from braised loin cuts.

A wide variation was found in the thiamine and riboflavin content of different pork carcasses. The niacin content is more constant.

Table 125*

FOODS	PROTEIN (GM.)	FAT (GM.)	CARBOHYDRATE (GM.)	WATER (GM.)	FIBER (GM.)	CALORIES (APPROX.)
Miscellaneous						
1. Beverages, carbonated 100 cc. (2/5 c.)	0	0	9	91	0	36
2. Candies, caramel 6–8	2	12	78	7	0	428
3. Candies, creams, chocolate 6–8	4	14	72	9	0	430
4. Candies, fudge piece ($2\frac{1}{4} \times 5 \times \frac{1}{2}$ in.)	2	4	88	5	0	336
5. Candies, marshmallows 12–14	3	0	81	15	0	336
6. Catsup 5/12 c.	2	*	25	70	0	108
7. Chocolate, bitter 3½ ounce squares	6	53	18	2	0	573
8. Chocolate, milk piece ($2\frac{1}{4} \times 5 \times \frac{1}{2}$ in.)	6	34	54	1	*	542
9. Chocolate, milk, with almonds piece ($2\frac{1}{4} \times 5 \times \frac{1}{2}$ in.)	8	39	50	1	*	583
10. Chocolate syrup (Hershey's) ⅝ c.	3	1	57	38	*	247
11. Cocoa, plain 1 c. scant	9	19	31	4	0	331
12. Eggs, whites 3–4	12	0	*	88	0	46
13. Eggs, whole, E. P. 2 eggs	13	12	1	74	0	158
14. Eggs, yolks 6–7	16	32	*	49	0	355
15. Gelatin, plain 10 tbs.	86	*	0	13	0	343
16. Ice cream, vanilla, average commercial ½ c.	4	12	21	62	0	210
17. Mayonnaise ½ c.	2	78	3	16	0	720
18. Olives, green 15	2	14	4	75	1	150
19. Olives, ripe 15	2	32	11	43	4	359
20. Pickles, cucumber 1 c.	1	*	2	95	*	12
21. Salad dressing, boiled ⅜ c.	5	10	15	68	0	760
22. Salad dressing, French 2/5 c.	1	39	17			423

—Continued

CALCIUM (MG.)	PHOSPHORUS (MG.)	IRON (MG.)	VITAMIN A (I. U.)	THIAMIN (μg)	RIBOFLAVIN (μg)	ASCORBIC ACID (MG.)	NIACIN (MG.)	REMARKS
4.0	60	0.4						
12	18	0 8	1,880	90	70	11	2.2	
95	343	2.5		+	240	0	1.1	
160	709	2.7	0	+	390	0	2.3	
13	15			+	250	0		
54	210	2.7	1,140	120	340	0		1–2.5 mg. pantothenic acid 15–45 I. U. vitamin D
147	586	7.2	3,210	320	520	0		5–10 mg. pantothenic acid, depending upon food of hen, 45–500 I. U. vitamin D, 2,500 curative units vitamin B_6 1713 mg. choline
132	104	0.1	540	40	190	±	0.1	
19	60	1.0	210	40	40	0		
101	15	2.0	420	+	0	0		
24	22	0.9	190	10	20	7	+	
5	5	0.1						

Table 125

Foods	Protein (gm.)	Fat (gm.)	Carbohydrate (gm.)	Water (gm.)	Fiber (gm.)	Calories (approx.)
Miscellaneous—Continued						
23. Yeast, bakers', dried 6 tbs.						
24. Yeast, bakers', fresh 8 cakes	14	*	8			100
25. Yeast, brewers', dried 6 tbs.	46	2	37	7		350
Jams, jellies, conserves, etc., are approximately 75% carbohydrates and yield 300 calories per 100 gms.						
Nuts						
1. Almonds 90–100 (¾ c.)	19	54	17	5	3	630
2. Brazil 15–20	14	66	9	5	2	686
3. Butternut 28–35	24	61	8	4	*	677
4. Cashew 90–100	20	47	26	4	1	609
5. Chestnut, fresh 40–50	3	2	40	53	1	190
6. Coconut, dry, shredded 1½ c.	4	41	50	3	4	585
7. Hazelnut (filbert) 90–100	13	61	14	6	3	657
8. Hickory 90–100	14	67	11	4	2	703
9. Peanuts, roasted 125–140 (¾ c shelled)	27	44	24	3	2	600
10. Peanut butter 5 tbs.	26	48	21	2	2	619
11. Pecans 90–100 (¾ c. shelled)	9	73	13	3	2	747
12. Pine nuts (pignolias) 225–250	31	48	11	5	1	605
13. Pistachio 225–250	20	53	16	6	2	621
14. Walnuts, black 90–100	18	58	17	3	2	622
15. Walnuts, Persian or English 90–100	15	64	16	3	2	702
Soup, Average Commercial, Undiluted						
1. Asparagus ²/₅ c. (approx. ⅓ can)	1	1	7	88	*	45
2. Bean ²/₅ c. (approx. ⅓ can)	6	2	14	75	1	100
3. Beef ²/₅ c. (approx. ⅓ can)	6	1	8	82	*	68

—Continued

CALCIUM (MG.)	PHOSPHORUS (MG.)	IRON (MG.)	VITAMIN A (I. U.)	THIAMINE (μg)	RIBOFLAVIN (μg)	ASCORBIC ACID (MG.)	NIACIN (MG.)	REMARKS
				2,000	3,000			
11	445	0.3		475	1,750		10	
106	1,893	18.2		9,690	5,450		36.2	4 mg. pyridoxine 500 mg. inositol 1.0-10 mg. para-amino-benzoic acid 20 mg. pantothenic acid
254	475	4.4	0	250	670	Nuts are entirely devoid of ascorbic acid	4.6	
176	592	4.0	10	1,000	70			
		6.8	+	++				
48	480		+	150	190			
34	93	4.1	80	240	+		1.0	
43	191	3.6	0	70	100			
287	354	4.1	280	500				
		2.9		600	++			
74	393	1.9	0	300	160		16.2	Peanuts and peanut butter contain 1,600 curative units vitamin B_6. Peanut meal contains 4-6 mg. pantothenic acid
74	393	1.9	0	300	160			
71	324	2.4	50	720	110		0.9	
		7.9	200					
89	358	6.0	130	330				
83	380	2.1	30	480	130		1.2	0.8 mg. pantothenic acid
								Usual dilution—equal parts of concentrated soup and water or other liquid

TABLE 125*

FOODS	PROTEIN (GM.)	FAT (GM.)	CARBOHYDRATE (GM.)	WATER (GM.)	FIBER (GM.)	CALORIES (APPROX.)
Soup, Average Commercial, Undiluted—Continued						
4. Bouillon 2/5 c. (approx. 1/3 can)	3	0	1	94	0	16
5. Celery 2/5 c. (approx. 1/3 can)	1	2	7	87	*	48
6. Chicken 2/5 c. (approx. 1/3 can)	1	1	5	89	*	33
7. Clam chowder 2/5 c. (approx. 1/3 can)	3	4	19	80	*	90
8. Pea 2/5 c. (approx. 1/3 can)	5	2	12	78	1	85
9. Tomato 2/5 c. (approx. 1/3 can)	2	2	9	84	*	58
10. Vegetable 2/5 c. (approx. 1/3 can)	3	2	10	80	*	68
Special Foods (Exact analyses are taken from manufacturers' literature and from *Accepted Foods*.)						
Cereals						
1. Blended cereal (canned, cooked and strained)	2.2	0.1	10.0	86.5	0.2	50
2. Cerevim (flaked and precooked) 2⅝ c. (1 oz.= 12 tbs.)	19.4	2.4	65.2	6	2	360
3. Clapp's Instant Cereal Pre-cooked	15	0.8	73.1	5.7	1.6	336
4. Gerber (flaked and precooked) 2⅝ c. (1 oz.= 12 tbs.)	12.4	1.3	74.9	5.6	1.3	360
5. Pablum (flaked and precooked) 2⅝ c. (1 oz.= 12 tbs.)	15.0	3.0	69.9	7.0	0.9	369
Flours						
1. Arrowroot 7 tbs. (1 oz.= 2 tbs.)	19.8	0.1	62.2			340
2. Banana 15 tbs. (1 oz.= 4 tbs.)	4.9	1.5	84.6			370
3. Barley 14 tbs. (1 oz.= 4 tbs.)	5.0	0	82.0			350
4. Gluten, 40% 11–12 tbs. (1 oz.= 3 tbs.)	41.4	1.9	46.8	8.5	0.4	372
5. Lister dietetic flour	54.5		(entirely hemicellulose) 22.8	7.0	1.0	

—Continued

CALCIUM (MG.)	PHOSPHORUS (MG.)	IRON (MG.)	VITAMIN A (I. U.)	THIAMINE (μg)	RIBOFLAVIN (μg)	ASCORBIC ACID (MG.)	NIACIN (MG.)	REMARKS
92	88	0.8	350	12	150			

CALCIUM (MG.)	PHOSPHORUS (MG.)	IRON (MG.)	VITAMIN A (I. U.)	THIAMINE (μg)	RIBOFLAVIN (μg)	ASCORBIC ACID (MG.)	NIACIN (MG.)	REMARKS
5.0	37	0.3		33				Beech-Nut Packing Co., Canajoharie, N. Y.
280	450	6.0		2,100	3,150		20.3	Lederle Laboratories, New York, N. Y. (Wheat, oats, barley, commercial brewers' yeast, salts, wheat germ, skim milk)
800	580	30.0		1,000		300		
680	800	30		840	350			Gerber Products Division, Fremont Canning Co., Fremont, Mich. (Wheat, corn, wheat germ, yeast, salts)
780	620	30		1,050	625			Mead Johnson & Co., Evansville, Ind.
								Lister Bros., Inc., New York City. (7 6% leavening in a blend of casein and hemicellulose

TABLE 125*

FOODS	PROTEIN (GM.)	FAT (GM.)	CARBOHYDRATE (GM.)	WATER (GM.)	FIBER (GM.)	CALORIES (APPROX.)
Special Foods—Continued						
Flours						
6. Poyo meal 8¾ tbs. (1 oz.=2½ tbs.)	2.0	0	76.5	7.5	1.5	375
7. Rice 14 tbs. (1 oz.=4 tbs.)	7.3	0.6	79.3			350
8. Soybean (high fat) 21 tbs. (1 oz.=6 tbs.)	37.3	20.2	9.5	6.9	2.5	379
Junior Foods (HEINZ)						
1. Apple, fig and date dessert ½ c. scant	0.6	0.2	23.6		1.0	98
2. Chicken, farina, vegetable porridge ½ c. scant	2.9	0.6	7.1		0.5	45
3. Chopped carrots ½ c. scant	0.9	0.1	4.4		0.7	21
4. Chopped mixed vegetables ½ c. scant	0.8	0.1	7.7		0.5	35
5. Chopped spinach ½ c. scant	1.8	0.2	1.7		0.7	14
6. Creamed, diced potatoes ½ c. scant	1.7	2.5	9.0		0.2	66
7. Creamed, diced vegetables ½ c. scant	2.1	1.2	8.8		0.3	52
8. Creamed green vegetables ½ c. scant	2.6	2.6	5.3		0.9	56
9. Creamed tomato and rice ½ c. scant	2.1	2.2	11.4		0.6	74
10. Lamb and liver stew ½ c. scant	2.9	2.2	8.0		0.7	63
11. Pineapple-rice pudding ½ c. scant	0.3	0.6	27.8		0.3	115
12. Prune pudding ½ c. scant	2.4	1.2	24.5		1.2	120
*Strained Meats**						
1. Beef 1 tin	17.7	3.0	0	78.6		96
2. Pork 1 tin	16.7	5.6	0	76.7		117
3. Lamb 1 tin	15.6	4.5	0	79.0		103
4. Veal 1 tin	16.4	1.0	0	82.1		75
5. Liver 1 tin	15.9	4.3	0	78.2		102

*Figures from Swift and Company Research Laboratories, Nutrition Division.

—Continued

CALCIUM (MG.)	PHOSPHORUS (MG.)	IRON (MG.)	VITAMIN A (I. U.)	THIAMINE (μg)	RIBOFLAVIN (μg)	ASCORBIC ACID (MG.)	NIACIN (MG.)	REMARKS
								Galen Company, Berkeley, Calif. (Root of the taro plant) 2.8 mg. pantothenic acid
			350	850	600		4.8	1.5 mg. pantothenic acid
39	19	2.7	22	18	42	2–3		H. J. Heinz Co., Pittsburgh, Pa.
43	72	2.3	138	81	105	1–2		
38	21	1.5	4,000	36	57	3		
39	26	5.4	1,700	27	55	2		
174	35	2.3	4,500	33	195	8		
42	55	0.7	110	33	92	3		
99	61	1.2	1,150	21	135	3		
60	50	4.6	845	51	145	3		
32	44	1.7	1,480	60	97	10		
65	63	5.5	3,100	27	182	3		
51	33	1.4	38	27	70	+		
69	54	1.1	300	30	175	3		
12	140	2.8		10	242		3.2	
14	180	1.7		346	278		4.7	
16	170	2.3		26	264		4.0	
17	180	1.6		24	288		4.9	
40	270	7.7		14	2,000		4.4	

TABLE 125

FOODS	PROTEIN (GM.)	FAT (GM.)	CARBOHYDRATE (GM.)	WATER (GM.)	FIBER (GM.)	CALORIES (APPROX.)
Special Foods—Continued						
*Strained Meats**						
6. Heart 1 tin	13.4	2.5	0	82.7		77
*Diced Meats**						
1. Beef ⅔ tin	23.0	4.1	0	71.8		129
2. Pork ⅔ tin	22.1	7.1	0	70.8		152
3. Lamb ⅔ tin	18.2	6.3		74.3		139
4. Veal ⅔ tin	20.4	2.1	0	76.7		100
5. Liver ⅔ tin	18.7	5.2	0	69.4		122
6. Heart ⅔ tin	17.3	5.1	0	75.0		115
Milks						
1. Acidophilus 7 tbs. (1 oz.=2 tbs.)	3.1	2.0	4.5			50
2. Biolac, A. P. 3½ oz. (100 c.c.)	5.4	4.6	15.7	73.0	0	140
3. Biolac, usual dilution Equal parts Biolac and water	2.8	2.4	8.2	86.0	0	70
4. Dryco, A. P. 21 tbs. (1 oz. = 6 tbs.)	31.5	12.2	46.8	3.1	0	420
5. Dryco, usual dilution	4.0	1.6	5.7	88.0	0	
6. Formulac	6.8	7.9	9.0	74.0	0	145
7. Goat milk, A. P. evaporated 7 tbs. (1 oz.=2 tbs.)	7.0	7.1	8.8			
8. Goat milk, usual dilution Dilution 1-1+	3.1	3.8	4.5			60
9. Human milk 100 c.c.= 5/12 c.= 3½ oz.	1.2-1.5	3.3-4.0	6.5-7.5	87.4		
10. Hypo Allergic milk, whole liquid, A. P. 100 c.c.= 5/12 c.= 3½ oz.	3.3	3.5	4.7			70
11. Hypo Allergic milk, skim liquid 100 c.c.= 5/12 c.= 3½ oz.	3.2	0.1	4.9			35
12. Hypo Allergic milk, whole milk powdered, A. P. 12½ tbs. (1 tbs.= 8 gm.)	25.5	29.0	36.0			510

* Figures from Swift and Company Research Laboratories, Nutrition Division.

—Continued

CALCIUM (MG.)	PHOSPHORUS (MG.)	IRON (MG.)	VITAMIN A (I. U.)	THIAMINE (μg)	RIBOFLAVIN (μg)	ASCORBIC ACID (MG.)	NIACIN (MG.)	REMARKS
12	150	3.6		64	818		4.5	
10	210	3.3		17	326		4.7	
14	200	1.5		452	238		3.7	
18	180	2.4		42	287		5.3	
11	210	1.6		52	350		6.3	
30	330	7.2		30	2,200		7.1	
15	220	4.8		156	1,067		4.4	
								The Borden Co., New York City
		0.6–0.7	200	6–8				34 I. U. vitamin D
		3.5						The Dry Milk Co. (Borden), New York City. (Partly skimmed milk, irradiated, fortified with rice polishing extract)
200	200	2.4	512	256	512		1.25	
								Special Milk Products, Inc., Los Angeles, Calif. Meyenberg Milk Products Co., Salinas, Calif.
		0.05	600	20		3–5		10 I. U. vitamin D
								S. M. A. Corporation, Cleveland, Ohio
								S. M. A. Corporation, Cleveland, Ohio
								S. M. A. Corporation, Cleveland, Ohio

Table 125*

FOODS	PROTEIN (GM.)	FAT (GM.)	CARBOHYDRATE (GM.)	WATER (GM.)	FIBER (GM.)	CALORIES (APPROX.)
Special Foods—Continued						
Milks						
13. Hypo Allergic milk, whole milk powdered Prepared, usual dilution 1 oz. to 8 oz. water	3.3	3.5	4.7			70
14. Klim, skim 12½ tbs. (1 tbs.=8 gm.)	35 0	2.0	51.0			360
15. Klim, whole 12½ tbs. (1 tbs.= 8 gm.)	26.7	28.	38.0	1.5		522
16. Koumiss 100 c.c.	3.2	2 0	6.0	90.0	0	265
17. Lactogen, A. P. 14 tbs. (1 oz.=4 tbs.)	16.2	25.	53.3	2.0	0	502
18. Lactogen, usual dilution 1 tbs. in 2 oz. water, 100 c.c.	2 0	3.1	6.7	87.8	0	60
19. Malted, plain 12 tbs. (1 oz.=3 tbs.)	13.8	6 8	71.9	3.5	0	400
20. Nestlé's food 14 tbs. (1 oz.=4 tbs.)	15.0	9.8	69.5	20.0	*	430
21. Olac, A. P. 1 oz.=3½ tbs.	23 4	18 5	53.1	1.5	0	470
22. Olac, usual dilution 1 oz. to 6 oz. water, 100 c.c.	4 7	3.7	7.6	86.0	0	85
23. Pelargon 13 tbs. (dry)	19.	20.	51.5	2.5		475
24. Recolac, A. P. 14 tbs. (1 oz.=4 tbs.)	52.3	16.0	27 0	1.4	0	460
25. Recolac, usual dilution 1 oz. to 7 oz. water, 100 c.c.	2.0	3.4	6 5		0	65
26. Similac, A. P. 14 tbs. (1 oz.=4 tbs.)	12.3	27.1	54.4	3.0	0	512
27. S. M. A. acidulated protein, A. P. 14 tbs. (1 oz.=4 tbs.)	35 0	22.0	28.0	2.0	0	478
28. S. M. A. acidulated protein, usual dilution 1 oz. to 9 oz. water, 100 c.c.	3.5	2 2	2.8		0	50
29. S. M. A. concentrated liquid	3.1	7 5	15.8	72 9	0	140

—Continued

CALCIUM (MG.)	PHOSPHORUS (MG.)	IRON (MG.)	VITAMIN A (I. U.)	THIAMINE (μg)	RIBOFLAVIN (μg)	ASCORBIC ACID (MG.)	NIACIN (MG.)	REMARKS
								S. M. A. Corporation, Cleveland, Ohio
								Merrell-Soule Division of The Borden Co., New York City (4 oz. powder + 29 oz. water = 1 qt. milk)
								Nestlé's Milk Products, Inc., New York City. (Whole milk + milk fat + lactose)
			+	++	++	0		(Whole milk and liquid separated from a mash of ground barley and wheat flour—dried)
450	350	3.5	1,400					Nestlé's Milk Products, Inc., New York City. (Dried malted whole wheat + condensed milk + wheat flour + C. L. O.) 140 I. U. vitamin D
			4,950					Mead Johnson & Co., Evansville, Ind. 84 I. U. vitamin D. (Dried skim milk + olive oil + Casec + dextrimaltose + haliver oil)
			1,238	198	429	8.25		
								Mead Johnson & Co., Evansville, Ind. (Defatted cow's milk + animal and vegetable fats + dextri-maltose)
								M and R Dietetic Laboratories, Inc., Columbus, Ohio. (Skim milk + casein + lactose + salts + animal and vegetable fats + cod-liver oil)
		0.01	9,900					S. M. A. Corporation, Cleveland, Ohio. 6% lactic acid. (Dry skim milk + casein + lemon juice). 813 I. U. vitamin D
		0 001	900					pH 4 6, 60 I. U. vitamin D
			1,700	150				S. M. A. Corporation, Cleveland, Ohio. 120 I. U. vitamin D. (Skim milk + lactose + beef fat + cocoa butter + cod-liver oil + salts)

TABLE 125*

FOODS	PROTEIN (GM.)	FAT (GM.)	CARBOHYDRATE (GM.)	WATER (GM.)	FIBER (GM.)	CALORIES (APPROX.)
Special Foods—Continued						
Milks						
30. S. M. A. powder	10.0	28.0	59.0	1.0	0	530
31. S. M. A. reliquefied Either 27 or 28 in normal dilutions, 100 c.c.	1.3–1.4	3.5–3.6	7.3–7.5		0	68
32. Whole milk, lactic acid, A. P. 12½ tbs. (1 tbs.=8 oz.)	26.5	28.0	32.5	2.3	0	505
3. Whole milk, lactic acid, full strength dilution 1 tbs. in 2 oz. water, 100 c.c.	3.0–3.3	3.3	3.8–4.0	88.4–88.7	0	50
4. Whole milk, protein, A. P. 14 tbs. (1 oz.=3½ tbs.)	39.0	26.5	27.0	1.5	0	500
5. Whole milk, protein, usual dilution (1 oz. to 11 oz. water)	3.3	2.2	2.0		0	45
Milk Paddings or Modifiers						
1. Banana Powder 2½ tbs.=1 banana=100 gm. (1 tbs.=8 gm.)	4.9	1.5	84.6	2.5	3.3	370
2. Betene 10 tbs. (1 tbs.=10 gm.)	31.8	5.6	43.3	3.6		360
3. Cal-C-Tose 10 tbs. (2 heaping tsp.=20 gm.)						
4. Cocomalt 10 tbs. (1 oz.=3 tbs.)	14.0	4.4	75.3			403
5. Dextrose with malted wheat germ extract 8 tbs. (1 tsp.=4 gm.)	4.0	0	89.0	1.0	0	390
6. Dietene 14 tbs. (1 oz.=4 tbs.)	37.1	3.7	44.9	6.5	*	361
7. Hemo-Powdered 10 heaping tsp.	7.7	4.3	74.7			368
8. Hemo-Liquid 8 heaping tsp.	5.6	3.5	60.5			296
9. Hylac	5.5	21.5	69.0	2.0		490
10. Mellin's Food 14 tbs. (1 oz.=4 tbs.)	10.3	*	79.6	5.6	*	360

—Continued

CALCIUM (MG.)	PHOSPHORUS (MG.)	IRON (MG.)	VITAMIN A (I. U.)	THIAMINE (μg)	RIBOFLAVIN (μg)	ASCORBIC ACID (MG.)	NIACIN (MG.)	REMARKS
			6,600	540				S. M. A. Corporation, Cleveland, Ohio. 460 I. U. vitamin D. (Skim milk + lactose + beef fat + cocoa butter + cod-liver oil + salts)
		1.0	750	60				S. M. A. Corporation, Cleveland, Ohio. 40 I. U. vitamin D. (Skim milk + lactose + beef fat + cocoa butter + cod-liver oil + salts)
								Merrell-Soule Division of The Borden Co., New York City, total acidity 5%
								Total acidity 0.78%, pH 4.5–4.8
								Mead Johnson & Co., Evansville, Ind. Lactic acid 3%
								Lactic acid 0.2%. Whey of whole milk + skim milk + lactic acid)
			960	90	300	13		Merck & Co., Inc., Rahway, N. J.
3,760	2,270		15,000	3,300	2,500	100		L. H. Stewart Co., Rochester, N. Y. 1,500 I. U. vitamin D
			10,000	2,250	500	150		Hoffmann-La Roche Co., Nutley, N. J. 5,000 I. U. vitamin D
515	560		2,800	787	125–188			R. B. Davis Co., Hoboken, N. J. 469 I. U. vitamin D. Barley malt, eggs, milk, cocoa
		4.0		735	500			E. R. Squibb & Sons, New York City
870	760		3,500	690	1,000	22		Dietene Co., Minneapolis, Minn. 150 I. U. vitamin D. Chocolate flavor
940	720	36.7	10,000	2,500	5,000		25	Vitamin D, I U. 1,000 The Borden Co.
752	576	29.4	10,000	2,500	5,000		25	Vitamin D, I.U. 1,000 The Borden Co.
				690				Nestle's Milk Products, Inc., New York City. (Whole milk + malted whole wheat extract + milk fat + lactose)
20	320	5.0						Mellin's Food Co., Boston, Mass. (A dried extract of wheat and barley)

TABLE 125*

FOODS	PROTEIN (GM.)	FAT (GM.)	CARBOHYDRATE (GM.)	WATER (GM.)	FIBER (GM.)	CALORIES (APPROX.)
Special Foods—Continued						
Milk Paddings or Modifiers						
11. Ovaltine, chocolate 17 tbs. (1 oz.=5 tbs.)	8.7	4.9	75.0		0	380
12. Ovaltine, plain 17 tbs. (1 oz.=5 tbs.)	14.0	7.4	70.0		0	525
13. Vitavose 14 tbs. (1 oz.=4 tbs.)	19.6	1.8	82.4	2.8	*	384
Milk Substitutes						
1. Cottonseed flour	54	7.	23.5	8.	2	373
2. Mull Soy, usual dilution equal parts of water and mull soy, 100 cc., 3½ oz.	3.0	3.9	4.4	87.7	*	70
3. Nutramigen 12 tbs. (3½ level tbs.=1 oz.)	20	18	55	2		
4. Sobee, A. P. 21 tbs. (1 oz.=6 tbs.)	33.0	22.5	32.6	2.4	1	470
5. Sobee, usual dilution 6 tbs. to 7 oz. water	4.2	2.8	4.1		*	60
Miscellaneous						
1. Casec 2⅝ c. (1 oz.=12 tbs.)	88.0	2.0	0	5.5	0	370
2. Cerophyl 1¼ c. (1 tbs.=5 gm.)						
3. Embo 12–13 tbs. (1 tbs.=8 gm.)	31.0	11.7	47.3			
4. Sanib (dried ripe banana)	3.2	1.1	66.0			286
5. Spintrate 1⅜ c. (4 tbs.=4½ gm.)	31.5	4.5	34.2			
6. V. B. W. (vitamin B wafers) 29 wafers (133 wafers per lb.)	6.6	11.4	78.6	2.3	*	435
7. V. C. B. (powder) vitamin C base ⅛ of 28 oz. can (1 oz.=8 tsp.)	*	0	97.8	2.0	*	390
8. Vegex 9 tbs. (1 tsp.=4+ gm.)	33.8	1.0	15.3			205

—Continued

CALCIUM (MG.)	PHOSPHORUS (MG.)	IRON (MG.)	VITAMIN A (I. U.)	THIAMINE (μg)	RIBOFLAVIN (μg)	ASCORBIC ACID (MG.)	NIACIN (MG.)	REMARKS
375	400	12 3	1,230	720	245			The Wander Co., Chicago, Ill. 700 I. U. vitamin D
575	575	17.5	1,500	1,200	125			
		4.0		600	300			E. R. Squibb & Sons, New York City. (Malted wheat germ with cocoa and skim milk)
				700	425			Traders Oil Mill Co., Fort Worth, Texas. (Partially defatted cooked cottonseed meal free from toxic substances)
130	110							Muller Laboratories, Baltimore, Md. (Soy bean flour, soybean oil and salts)
800	700	10						Mead, Johnson & Co., Evansville, Ind. (Amigen, dextri-maltose, corn oil, arrowroot starch, yeast, and mineral salts)
1,450	1,400	20						Mead Johnson & Co., Evansville, Ind. (Soybean flour, olive oil, arrowroot starch dextri-maltose, and salts)
1,800	600							Mead Johnson & Co., Evansville, Ind.
			70,000 as carotene	900	2,500	350		Cerophyl Laboratories, Inc., Kansas City, Mo. (Dried grasses and cereal grains—wheat, oats and barley) Rich source of grass juice factor and vitamin K
			+	2,620	1,000			General Mills, Inc., Minneapolis, Minn. Source of vitamin E
24.3	83.7	4.75	1,360	43	800	+	1.5	Sanib Corporation, 122 East 42nd St., New York
1,030	640	53						
79	39		8,700					Hilker & Bletsch Co., Cincinnati, Ohio. 100 micrograms vitamin B_1 per wafer
						107		Hilker & Bletsch Co., Cincinnati, Ohio. ½ oz. (14 gm.) powder to 4 oz. (118 c.c. water) contains 50 mg. ascorbic acid
444	423	70		13,500	11,250			

Table 125*

FOODS	PROTEIN (GM.)	FAT (GM.)	CARBOHYDRATE (GM.)	WATER (GM.)	FIBER (GM.)	CALORIES (APPROX.)
Miscellaneous—Continued						
High Protein Foods						
1. Somagen	70		22			390
2. Protein hydrolysate	60	1.5	4			237
3. P.H.V.	43		46			
4. Nutragest	45		48.5			360
5. Vipeptolac	50	2.0	37.0	2.0	0	360
Strained Foods (Heinz)						
1. Apricot and applesauce ½ c.	0.6	0.1	14.4		0.7	60
2. Asparagus ½ c.	1 9	0.3	5 4		0.8	31
3. Beef and liver soup ½ c.	5.1	1 0	5.6		0.2	52
4. Beets ½ c.	1.5	0 1	7.5		0 6	35
5. Carrots ½ c.	1.0	0.2	5 7		0.8	28
6. Cereal ½ c.	2 6	0 1	8.4		0 2	45
7. Green beans ½ c.	2 2	0 2	3.8		0 8	25
8. Mixed greens ½ c.	2.3	0 2	2 3		1.2	21
9. Pears and pineapple ½ c.	0 4	0 4	12 9		1 0	56
10. Peas ½ c.	4 9	0 5	8 8		1 0	60
11. Prunes ½ c.	1.1	0.2	28.2		0 8	120
12. Spinach ½ c.	2.2	0 5	1 5		0.7	17

—Continued

CALCIUM (MG.)	PHOSPHORUS (MG.)	IRON (MG.)	VITAMIN A (I. U.)	THIAMINE (μg)	RIBOFLAVIN (μg)	ASCORBIC ACID (MG.)	NIACIN (MG.)	REMARKS
				500	500		30	Upjohn Co. mixture of proteins derived from milk, liver, and yeast 2 mg. pyridoxine 10 mg. calcium pantothenate 2 mg. folic acid
			16,500	330	198	100	50	1,650 U.S.P. vit. D units 3.3 mg. pyridoxine 3.3 mg. calcium pantothenate enzymatic digest of casein Walker
				6,600	10,000		66	5 mg. pantothenic acid 0.8 mg. pyridoxine 0.12 mg. biotin 0.40 mg. folic acid 120 mg. choline enzymatic hydrolysate of yeast and meat American Home Products Corp.
		28	5,000	1,000	2,000	50	10	1.12 gm. calcium gluconate protein hydrolysate from lactalbumin casein and yeast Burroughs Wellcome & Co.
1,200	1,000	25.0	8,000	6,000	12,000	60	12.0	2 mg. folic acid protein food supplement supplying amino acids from lactalbumin and casein
12	19	1.3	3,100	21	45	9		H. J. Heinz Co., Pittsburgh, Pa.
14	36	1.0	1,650	93	140	20		
25	190	1.8	10,550	39	220	8		
17	37	1.6	50	15	27	+		
29	29	1.0	6,160	24	52	5		
11	68	0.5	0	48	63	0		
52	31	1.0	1,300	39	77	12		
105	50	1.4	4,200	39	122	22		
13	10	1.1	165	36	42	3		
12	830	1.6	1,680	126	122	14		
33	32	1.8	200	42	142	9		
57	39	1.0	5,530	29	105	18		

TABLE 125*

FOODS	PROTEIN (GM.)	FAT (GM.)	CARBOHYDRATE (GM.)	WATER (GM.)	FIBER (GM.)	CALORIES (APPROX.)
Special Foods—Continued						
Sugars						
1. Alerdex ⅞ c. (4 tbs.=1 oz.)	0	0	96.5	2 3	0	385
2. Beta lactose	0	0	100.0	0	0	400
3. Cartose ⅓ c. (1 tbs.=20 gm.)	0.1	0	74 5	25.0	0	430
4. Dexin 10½ tbs. (3 tbs.=1 oz.)	0.4	0.2	97.8		0	400
5. Dextri-Maltose ⅞ c. (4 tbs.=1 oz.)	0 2	0.2	93.0	1.0	0	380
6. Karo 7 tbs. (2 tbs.=1 oz.)	0 2	0	73.9		0	300
7. Lactose 10½ tbs. (3 tbs.=1 oz.)	0	0	100.0	0		
Sugars						
1. Brown, dark 10 tbs. or ⅝ c.	0	0	96 0	3.0	0	384
2. Corn syrup 6 tbs. or ⅜ c.	0	0	86.0	14 0	0	344
3. Granulated ⅝ c.	0	0	100.0	0	0	400
4. Honey, strained 5 tbs.	0	0	80	20	0	320
5. Loaf 14 cubes	0	0	100	0	0	400
6. Maple 1 piece (1¾×1¼×½ in.)	0	0	90	8	0	360
7. Maple syrup 6 tbs. or ⅜ c.	0	0	74	26	0	296
8. Molasses, cane ⅓ c.	0	0	60	24	0	240
9. Powdered ½ c.	0	0	100	0	0	400
Vegetables						
1. Artichokes, French or Globe 4 small heads	3	0	12	84	3	60
2. Asparagus, canned, green 8 tips or ½ c.	2	0	3	94	0	20

—Continued

CALCIUM (MG.)	PHOSPHORUS (MG.)	IRON (MG.)	VITAMIN A (I. U.)	THIAMINE (μg)	RIBOFLAVIN (μg)	ASCORBIC ACID (MG.)	NIACIN (MG.)	REMARKS
								S. M. A. Corporation, Cleveland, Ohio
								The Borden Co., New York City. 5 times more soluble than regular form (alpha)
								Scientific Sugars Co., Indianapolis, Ind.
								Burroughs Wellcome & Co., New York City
								Mead Johnson & Co., Evansville, Ind.
								Corn Products Refining Co., New York City
76	37	2.6						
60	7	2.7						
5	16	0.9		3–9	40	4		0.2–0.4 mg. B_6 0.2 mg. pantothenic acid
107	13	3						
273	51	6.7		80	160		2.8	Cane molasses is a good source of vitamin B_6 and contains pantothenic acid and vitamin B_2. Beet molasses is devoid of all vitamins
40	94	1.0	200	125	30	9		Belongs to thistle family
20	34	1.0	600	90		15	0.8	128 mg. choline

Table 125*

FOODS	PROTEIN (GM.)	FAT (GM.)	CARBOHYDRATE (GM.)	WATER (GM.)	FIBER (GM.)	CALORIES (APPROX.)
Vegetables—Continued						
3. Asparagus, fresh, green 5 stalks, 8 tips or ½ c.	2	0	4	93	1	24
4. Beans, baked, canned with pork ½ c. scant	6	2	19	71	1	117
5. Beans, butter, fresh ⅔ c.	2	0	8	89	1	40
6. Beans, dried, navy ½ c.	22	2	62	11	4	350
7. Beans, kidney, canned ½ c.	6	0	16	76	1	92
8. Beans, Lima, dried ⅔ c.	21	1	62	13	4	341
9. Beans, Lima, fresh ⅔ c.	8	0	24	67	2	131
10. Beans, soy, dried ½ c.	35	18	12	8	5	350
11. Beans, soy, fresh ¾ c.	13	7	4	67	2	132
12. Beans, string, canned ½ c.	1	0	4	94	1	20
13. Beans, string, fresh ⅔ c. (1 in. pieces)	2	0	8	89	1	40
14. Bean sprouts (mung beans) 1 c. scant	3	0	4	92	1	28
15. Beets, fresh ½ c. or 2 beets (2 in. diam.)	2	0	10	88	1	48
16. Beet greens 3 c. (½ c. cooked)	2	0	6	90	1	32
17. Broccoli, flower stalks ⅔ c.	3	0	6	90	1	36
18. Brussels sprouts 8–10 or ⅔ c.	4	*	9	85	1	52
19. Cabbage, fresh 2½ c. shredded (½ c. cooked)	1	*	5	92	1	24
20. Carrots ½–¾ c. diced	1	*	9	88	1	40
21. Cauliflower ½–¾ c.	2	*	5	92	1	31
22. Celery, bleached 1 heart with 3 stalks	1	*	4	94	1	20
23. Chard, leaves 3 c. shredded (⅓ c. cooked)	1	*	4	91	1	20

—Continued

CALCIUM (MG.)	PHOSPHORUS (MG.)	IRON (MG.)	VITAMIN A (I. U.)	THIAMINE (g)	RIBOFLAVIN (μg)	ASCORBIC ACID (MG.)	NIACIN (MG.)	REMARKS
21	62	0.9	1,000	160	170	33	1.2	pantothenic acid+
49	154	3.4	70	50	50	0	0.8	
55	500	1.2	350	87	100	10–20	0.3	340 mg. choline
148	463	10.3		60	240	2	2.1	400 curative units of vitamin B_6
44	139	3.0						
68	381	7.5		60	240	2		
63	158	2.3	280	250	140	32	0.9	
227	586	8.0	110	1,140	310	+	2.1	
			330	800	300	40	4.8	340 mg. choline
27	19	1.4	410	30	50	4	0.3	Pantothenic acid +
65	44	1.1	630	80	100	19	0.6	
42	54	1.0				+++		
27	43	1.0	20	30	50	10	0.4	Pantothenic acid + 13 curative units vitamin B_6
118	45	3.2	6,700	50	170	35	0.3	
130	76	1.3	3,500	90	210	118	0.9	1.4 mg. pantothenic acid
34	78	1.3	400	110	60	94	0.3	
46	31	0.5	80	70	60	52	0.3	0.3 mg. B_6 251 mg. choline 0.23 mg. pantothenic acid
39	37	0.8	12,000	70	60	6	0.5	95 mg. choline 0.2 mg. pantothenic acid
22	72	1.1	90	100	110	69	0.6	
50	40	0.5		30	40	7	0.3	
105	36	4.0	2,700	60	130	38	0.2	

Table 125*

FOODS	PROTEIN (GM.)	FAT (GM.)	CARBOHYDRATE (GM.)	WATER (GM.)	FIBER (GM.)	CALORIES (APPROX).
Vegetables—Continued						
24. Corn, canned ½ c. or 2 ears (4 in. long)	2	0	16	76	*	72
25. Corn, yellow sweet, fresh 2 ears (4 in. long), ½ c.	4	1	20	74	1	105
26. Cucumber ½ c. sliced	1	*	2	96	1	14
27. Dandelion greens 3 c. shredded (½ c. cooked)	3	1	9	86	2	57
28. Eggplant 4 avg. slices (⅔ c. diced)	1	1	6	93	1	37
29. Endive, French 15–20 stalks	2	*	4	93	*	24
30. Escarole (endive) ½ head (2–4 stalks)	2	*	3	93	1	24
31. Kale (collards) 1 c. cooked	4	*	7	87	1	44
32. Kohlrabi ½–¾ c. diced	2	*	6	90	1	36
33. Leeks 3–4 (5 in. long)	2	*	7	88	1	45
34. Lentils, dried, whole ½ c.	25	1	57	11	3	345
35. Lettuce ¼–⅓ head or 12 medium leaves	1	*	3	95	1	16
36. Mushrooms ½ c. canned (1 c. fresh)	?	*	?	91	1	?
37. Okra 5 pods	2	*	7	90	1	36
38. Onions 5–6 small or 2 large (½ c. sliced)	1	*	10	88	1	44
39. Parsley 1 bunch (5 in. diam.)	4	1	8	84	2	60
0. Parsnips ½ c. cubed	2	1	18	79	2	89
41. Peas, canned, drained ½ c.	3	*	13	85	1	64
42. Peas, dried, split ½ c.	25	1	62	10	1	357
43. Peas, green, fresh ¾ c.	7	*	18	81	2	100
44. Peppers, green 1 (3–4 in. long)	1	*	6	92	1	28

—Continued

CALCIUM (MG.)	PHOSPHORUS (MG.)	IRON (MG.)	VITAMIN A (I. U.)	THIAMINE (μg)	RIBOFLAVIN (μg)	ASCORBIC ACID (MG.)	NIACIN (MG.)	REMARKS
4	51	0.5	200	20	50	5	0.8	
9	120	0.5	390	150	140	12	1.4	0.8 mg. pantothenic acid 0.2 mg. para-aminobenzoic acid
10	21	0.3		40	90	8	0.2	
187	70	3.1	13,650	190	140	36	0.8	
15	37	0.4	30	70	60	5	0.8	
104	39	1.2	1,000	75	60	10		
104	39	1.2	15,000	110	125	8		
225	62	2.2	7,540	120	350	115	0.8	0.3 mg. pantothenic acid
78	57	0.6	10,000	55		65		
58	56	0.6		120		15		
102	383	8.6		425	257			
22	25	0.5	540 head	60	70	8		
62	20	1.1	1,620 green leaves	60	70	18		
14	98	0.7	0	150		4.5		
82	62	0.7	740	120	100	30	0.7	
32	44	0.5	50	30	20	9	0.1	0.1 mg. pantothenic acid Green onions, 5,000 I. U. vitamin A; mature ones, 0
		3.2	30,000			125		
57	80	0.7		110	90	18	0.2	
25	67	1.8	540	110	60	8	0.9	+ pantothenic acid
73	397	0.6	370	870	290		1.8	2.1 mg. pantothenic acid
22	122	1.9	680	360	180	26	2.1	260 mg. choline 0.4 mg. pantothenic acid
11	25	0.4	630	70	40	120	0.4	

TABLE 125*

FOOD	PROTEIN (GM.)	FAT (GM.)	CARBOHYDRATE (GM.)	WATER (GM.)	FIBER (GM.)	CALORIES (APPROX.)
Vegetables—Continued						
45. Peppers, red 1 (3–4 in. long)	1	1	7	89	2	44
46. Potato chips 4 c.	7	37	49	3	*	557
47. Potatoes, fresh 1 small (2½ in. diam.) (¾ c. riced)	2	*	19	78	*	84
48. Potatoes, sweet (yam) ½ medium or 1 small	2	*	28	69		120
49. Pumpkin, canned ½ c.	1	*	8	90	1	36
50. Pumpkin, fresh ¾ c. diced	1	*	7	91	1	32
51. Radishes 10 medium or 15 small	1	0	4	46	*	20
52. Rutabagas, yellow (Swede) ⅔ c. (½ in. cubes)	1	*	9	89	1	40
53. Salsify (vegetable oyster) ⅔ c. diced	4	1	14	79	2	85
54. Sauerkraut, canned ¾ c.	1	*	4	91	1	20
55 Spinach, canned ½ c.	2	*	3	92	1	20
56. Spinach, fresh 3 c. (½ c. cooked)	2	*	3	93	1	20
57. Squash, summer ¾ c. diced (½ c. cooked)	1	*	4	95	1	20
58. Squash, winter (Hubbard) ¾ c. diced (½ c. cooked)	2	*	9	89	1	44
59. Tomato, canned ½ c.	1	*	4	92	*	20
60. Tomato, fresh 1 medium (2½ in. diam.)	1	*	4	94	1	20
61. Tomato, green 1 medium	1	*	3	95	*	20
62. Tomato juice, canned ²/₅ c.	1	*	4	94	*	20
63. Turnip, white ⅔ c. (½ in. cubes)	1	*	7	91	1	32
64. Turnip greens 3 c. (½ c. cooked)	3	*	5	90	1	32
65. Water cress 2½ c.	2	*	3	94	1	20

—Continued

CALCIUM (MG.)	PHOSPHORUS (MG.)	IRON (MG.)	VITAMIN A (I. U.)	THIAMINE (μg)	RIBOFLAVIN (μg)	ASCORBIC ACID (MG.)	NIACIN (MG.)	REMARKS
			5,000	30	138	215		
5	21	0.4						
11	56	0.7	20	110	40	17	1.2	0.16 mg. pyridoxine 0.3–0.7 mg. pantothenic acid 100 mg. choline
30	49	0.7	7,700	100	60	22	0.7	35 mg. choline 1.0 mg. pantothenic acid
20	36	0.7	3,400	20	60		0.5	
21	44	0.8	3,400	50	80	8	0.7	0.4 mg. pantothenic acid
37	31	1.0	30	40	40	24	0.1	
55	41	0.4	330	60	60	36	0 5	
46	31	0.5	+	30	20	18	0.2	
90	33	1.6	6,790	20	80	14	0.3	
81	55	3.0	9,420	120	240	59	0.7	238 mg. choline 0.1–0.2 mg. pantothenic acid 66 curative units vitamin B_6
15	15	0.4	260	40	50	17	1.1	
19	28	0.6	4,950	50	80	8	0.6	
11	27	0.6	1,050	50	30	16	0.7	
11	27	0.6	1,100	60	40	20	0.6	24 curative units vitamin B_6 0.1 mg. pantothenic aied
11	27	0.6						
7	15	0.4	1,050	50	30	16	0.7	
40	34	0.5	+	60	60	28	0.5	0.25 mg. pantothenic acid +
259	50	2.4	9,540	100	560	136	0.8	
157	46	3.0	2,350	125	225	55		

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